PROCEEDINGS OF THE

Bournemouth Natural Science Society.

: : VOL. V. : :

SESSION 1912-1913.

PUBLISHED BY THE SOCIETY AT ITS ROOMS,
THE MUNICIPAL COLLEGE, BOURNEMOUTH, 1914.

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See BOSSES AND CORBELS OF EXETER CATHEDRAL.
By Prideaux and Holt Shafto.

Introductory Note.

THE BOURNEMOUTH NATURAL SCIENCE SOCIETY was founded in 1903, being the successor to an older society which was formed in 1883 and dissolved in 1897. Its objects are declared by the second of its rules to be "the promotion of the study of Science in all its branches, by means of Lectures, Field Meetings, the Reading and Discussion of Papers, and the formation of Sections of its members devoted to any particular branch of the Society's work."

The Sections at present working are as follows:— **Archæological and Historical, Botanical, Geographical, Geological, Microscopical and Zoological, Photographical, and Physical.**

During the WINTER SESSION, from October to April, GENERAL and SECTIONAL MEETINGS are held. TWO GENERAL MEETINGS are usually held in each month, comprising Lectures and Demonstrations on various subjects of scientific interest, illustrated by lantern slides, diagrams, or specimens. These meetings are held on Saturdays at 4.30 p.m.

SECTIONAL MEETINGS are usually held on Thursdays and Saturdays at 4.30 p.m., but occasionally on other days, each Section being allotted one monthly meeting. At these, the papers read are more specialized and technical than at the General Meetings.

GENERAL MEETINGS, as a rule, are held at Trinity Hall, Lorne Park, and SECTIONAL MEETINGS at the Society's Room in the Municipal College.

Throughout the SUMMER SESSION, GENERAL EXCURSIONS to places of interest in the neighbourhood are arranged once or twice in each month, usually on Wednesdays. SECTIONAL EXCURSIONS also take place once in each week, on Wednesdays or Saturdays.

The management of the Society is vested in a Council, which is elected at the Annual General Meeting, held in October.

The Members are elected by the Council, and pay an annual subscription of Ten Shillings for full membership (admitting to all meetings and excursions for the year). Visitors to Bournemouth are permitted to join for the Winter or Summer Sessions on payment of seven shillings and sixpence, if approved by the Council.

The Society is endeavouring to lay the foundations of a MUSEUM by acquiring collections of archæological, botanical, geological, zoological, and other specimens of scientific interest. A good beginning has already been made in several directions, especially by the acquisition, during the past year, of the valuable Dent Collection of Barton Fossils. Particulars as to the objects and hopes of the Society in this direction will be found in the special article contributed to this volume by the President.

A MONTHLY NOTICE, giving full details of all meetings, etc., is posted to every member before the beginning of each month, and a volume of Proceedings is published every year.

Application Forms for Membership, and further particulars, can be obtained from the

HON. SECRETARY,

Bournemouth Natural Science Society,
Municipal College,
Bournemouth.

Bournemouth Natural Science Society.

OFFICERS AND COUNCIL FOR 1913—1914.

President:

SIR DANIEL MORRIS, K.C.M.G., M.A., D.SC., D.C.L., F.L.S.

Vice-Presidents:

†[G. BROWNEN, F.C.S.]
C. E. J. CRALLAN, M.A., M.B., M.R.C.S.
J. E. LIDDIARD, F.R.G.S., M.N.G.S. of U.S.A., M.J.S.
REV. E. F. LINTON, M.A.
DR. W. T. ORD, F.G.S.
DR. A. RANSOME, M.A., F.R.S.
MISS C. AGNES ROOPER.
DR. J. ROBERTS THOMSON, J.P.
H. J. WADDINGTON, F.L.S.

Chairman of Council:

SIR DANIEL MORRIS, K.C.M.G., J.P.

Vice-Chairman of Council:

G. G. HAMILTON, M.B., F.R.C.S. ENG.

Council:

THE OFFICERS (ex-officio) and

HENRY BACKHOUSE.
J. M. FRENCH.
G. G. HAMILTON, M.B., F.R.C.S., ENG.
S. MCCALMONT HILL, D.C.L.
SIR DANIEL MORRIS, K.C.M.G., M.A., F.L.S.
H. LE JEUNE.
J. H. SCOTT, M.E., M.I.M.C.E.
R. V. SHERRING, F.L.S.

Chairmen of Sections:

†Archæological and Historical: [G. BROWNEN, F.C.S.]
Botanical: MISS C. AGNES ROOPER.
Geographical: G. DE CASTRO, M.R.C.S., ENG.
Geological: DR. W. T. ORD, F.G.S.
Microscopical: H. B. WELLS, F.R.M.S.
Photographical:
Physical: HUBERT PAINTER, B.SC., F.C.S.
Zoological: W. MUNN RANKIN, M.SC., B.SC.

Hon. Treasurer:

G. BRUMELL, A.R.I.B.A.

Secretaries:

†*Hon. Secretary:* [T. MICHELL, M.I.C.E., Trewirgie, Christchurch Road, Bournemouth.]
**Assistant Hon. Secretary:* R. A. DE PAIVA, San Remo, Carysfort Road, Bournemouth.
Assistant Secretary: J. F. SPENCER, Glenthorne, Richmond Park Road, Bournemouth.

Hon. Librarian:

W. MUNN RANKIN, M.SC., B.SC.

Hon. Editor:

HUBERT PAINTER, B.SC., F.C.S.

Hon. Auditors:

H. SUTTON. E. BICKER.

Bankers:

NATIONAL PROVINCIAL BANK OF ENGLAND, BOURNEMOUTH.

PAST PRESIDENTS:

1903-4	..	J. E. BEALE (Mayor of Bournemouth).
1904-5—1905-6	..	G. E. J. CRALLAN, M.A., M.B., M.R.C.S.
1906—1907	..	H. J. WADDINGTON, F.L.S.
1907-8—1908-9	..	DR. A. RANSOME, M.A., F.R.S.
1909-10	..	DR. A. SMITH WOODWARD, LL.D., F.R.S., F.L.S., F.G.S.
1910-11	..	DR. DUKINFIELD H. SCOTT, M.A., LL.D., F.R.S., F.G.S.
1911-12—1912-13	..	SIR RAY LANKESTER, K.C.B., M.A., LL.D., F.R.S., F.L.S.

†Resigned since Jan. 1st, 1914. *Elected Hon. Secretary, March 1914.

Annual Meeting, 1913.

THE Annual Meeting for 1912—13 was held in the Society's Room, Municipal College, Lansdowne, on Saturday, October 25th, at 4.30 p.m.

On the motion of Sir Daniel Morris, the chair was taken by Mr. H. J. Waddington, Senior Vice-President. A letter of apology was read from Dr. W. T. Ord, regretting his being unavoidably absent.

The Chairman, after a few opening congratulatory remarks, called on the Hon. Secretary to read the Minutes of the previous Annual Meeting, which were unanimously passed. The Chairman expressed the regret of the members for the absence of the Hon. Treasurer, Mr. G. Brumell, due to illness, and hoped he would soon be restored to health; he then asked the Hon. Secretary to read the Audited Annual Statement of Accounts, which showed a total expenditure of £199 9s. 7d., and carrying forward a balance of £76 1s. 4d. On the proposition of Mr. J. E. Liddiard, seconded by Dr. Moorhead, the Council's Report and the Accounts were unanimously adopted, both speakers complimenting the Society on the work done during the year, and on the very satisfactory Statement of Accounts.

The Reports of the Sections were then read by the following Chairmen of Sections, details of which appear in the volume:—

The Archæological and Historical, by Mr. Geo. Brownen.
The Botanical, by Miss C. Agnes Rooper.
The Geographical, by Mr. G. de Castro.
The Geological, by Mr. H. St. Barbe, in the absence of Dr. Ord.
The Photographical by the Hon. Secretary, for Mr. Geo. Brumell.
The Physical by Mr. Hubert Painter.
The Zoological and Microscopical by Mr. H. B. Wells.

The Hon. Librarian, Mr. W. Munn Rankin, then read his report.

A vote of thanks was then proposed by Sir Daniel Morris to the retiring President, Sir E. Ray Lankester, K.C.B., F.R.S., for the valued services rendered by him during the two years he had held the Presidential Chair. Mr. H. J. Waddington, in seconding the vote, referred to the assistance Sir Ray was always ready to give to those who sought his advice, and to whom he proved a true friend. The vote was carried unanimously, and the Hon. Secretary was requested to convey the resolution of thanks to Sir E. Ray Lankester.

The Chairman, in proposing the election of Sir Daniel Morris, K.C.M.G, J.P., D.C.L., D.Sc., F.L.S., to be President for the ensuing year, stated that the Council were unanimous in recommending the nomination of their esteemed Chairman to the Presidential Chair. During the time he had been with them he had been an active worker in doing all he could for the welfare of the Society; and as he resided amongst them he would make an ideal President to welcome and support the Congress of the South-Eastern Union of Scientific Societies, which was being held in Bournemouth next year. Miss C. Agnes Rooper, in a few graceful words, seconded the proposition, which was carried unanimously with applause.

Sir Daniel Morris briefly replied, stating how deeply he appreciated the honour, and that he would do all in his power to promote the welfare and prosperity of the Society. As Chairman of the Council for the past two years he had observed with pleasure the energy displayed by the Society in its efforts to secure a Natural Science Museum for the benefit of the town, and in the acquisition of the Dent Collection of Barton fossils, and he accepted the honour which the members had conferred upon him with very great pleasure.

The re-election of all the Vice-Presidents was carried, on the motion of Mr. H. Backhouse, seconded by Mr. W. H. Scott.

On the proposition of Dr. Shillitoe, seconded by Mr. T. J. P. Jeffery, the Executive and other officers were unanimously re-elected.

The members of the Council were re-elected, on the proposition of Mr. Aubrey Edwards, seconded by Mr. C. R. Rutherford.

A hearty vote of thanks was given to the Auditors, Messrs. Sutton and Bicker, for their gratuitous services, on the proposition of Mr. F. L. Jermyn, seconded by Mr. A. Gray.

Sir Daniel Morris proposed a vote of thanks to Mr. H. J. Waddington for his efficient services in the chair, which was carried by acclamation. Mr. Waddington briefly responded.

Mr. H. J. Ellis proposed a vote of thanks to the Hon. Secretaries for their work during the year, which was passed and briefly acknowledged.

Summary of Cash Account for year ending 30th September, 1913.

RECEIPTS.

	£	s.	d.
By Balance on 1st October, 1912	78	17	5
,, Members' Subscriptions	179	0	0
,, Subscriptions in Advance for 1913-14 ...	5	0	0
,, Proceeds of Lectures	0	14	0
,, Sale of Volumes of Proceedings	0	13	0
,, Surplus from Excursions	5	3	7
,, Refund of Money Paid Out for Student's Association	2	17	10
,, Sundry Receipts.	3	5	1
	£275	10	11

PAYMENTS.

	£	s.	d.	£	s.	d.
To Rent, Granville Chambers, to Lady Day	12	2	6			
,, Rent Municipal College, from Lady Day	12	10	0			
				24	12	6
,, Hire of Trinity Hall				9	7	6
,, Salary of Assistant Secretary				10	0	0
,, Caretaker's Wages (to Lady Day) ...				1	8	6
,, Cost of Vol. IV. of Proceedings				36	17	9
,, Printing and Stationery				19	8	6
,, Furniture and Upkeep of Rooms ...				36	1	6
,, Expenses of Lectures				13	8	9
,, Postage				21	0	6
,, Subscriptions to other Societies				4	19	0
,, Insurance				0	5	0
,, In connection with Collections of specimens				11	12	9
,, Paid out for Student's Association ...				2	17	10
,, Cost of Removal from Granville Chambers				2	5	0
,, Journal of Botany				0	16	0
,, Sundries				4	8	6
				£199	9	7
Balance at Bank				76	1	4
				£275	10	11

(Signed) G. BRUMELL, Hon. Treasurer.

We have examined the foregoing Account with the Books of the Society and the vouchers for payments, and certify the same to be correct.

(Signed) EDWARD BICKER
HERBERT SUTTON
Auditors.

Bournemouth,
20th October, 1913.

Council's Report

for the Year ending September 30th, 1913.

THE Council, in presenting the Tenth Annual Report, has much pleasure in recording another year of continued activity and prosperity. Subscriptions have been received from 473 members, but owing to deaths and resignations the number on the books at the end of the year was 426, an increase of 8 on the membership for 1912.

During the year general and other meetings were held as follows:—

The Annual Meeting.
11 General Lectures.
31 Sectional Lectures.
8 General Excursions and
24 Sectional Excursions.

making a total of 75 meetings as compared with 73 held in the previous year:—

The General Lectures were as follows:—

1912.

Nov. 9th.—"The Lakeland of Dorset," by Mr. Harry Pouncy.

Nov. 30th.—A comparison of some of the diseases occurring in Animals with those affecting Plants," by Mr. G. G. Hamilton, F.R.C.S., F.R.H.S.

Dec. 21st.—"Evolution of Plant Forms," by the Rev. Professor George Henslow, M.A., F.L.S., F.G.S.

1913.

Jan. 11th.—"A Walk Round the Walls of Old Southampton," by Mr. William Dale, F.S.A., F.G.S.

Jan. 25th.—"The Rapid Spread of the Rice or Cord Grass (*Spartina*), and its Value as a Land Builder on the Hampshire and Dorset Coasts," by Dr. Otto Stapf, F.R.S., F.L.S., Royal Gardens, Kew.

Feb. 1st.—"Australia," by the Rev. Dr. Tristram Spry Carlyon.

Feb. 15th.—"Prehistoric Animals," by Mr. Willinghame F. Rawnsley, M.A., J.P.

Mar. 15th.—"The Scales of Fish," by Mr. W. A. Willes.

Mar. 29th.—"Early Days of Christianity in Rome and Recent Explorations," by Mr. William Ravenscroft, F.R.I.B.A., F.S.A.

April 12th.—"The Life and Work of Lord Kelvin," by Mr. Hubert Painter, B.Sc., F.C.S.

April 26th.—"Flowers in Stone as Applied to Church Architecture," by Miss Ida M. Roper, F.L.S.

All were illustrated with Lantern Slides.

The General Excursions with their Conductors in each case were as follows:—

1913.

May 14th.—Shaftesbury, Hod Hill, and Cranborne Chase, by the Rev. F. Ehlvers, Rector of Shaftesbury, and Mr. George Brownen.

May 28th.—Athelhampton Hall, Puddletown and Bere Regis Churches, by Mr. George Brownen.

June 12th.—A Cruise in Poole Harbour (the Lakeland of Dorset), by Mr. Harry Pouncy.

June 25th.—Sherborne, by Colonel Sir Wm. Watts, K.C.B.

July 5th.—Milton Abbey and Bingham's Melcombe, by the Rev. Herbert Pentin, M.A.

July 16th.—Wilton House, by Alderman E. Slow and Sir Daniel Morris.

August 20th.—Salisbury and Old Sarum, by Colonel Hawley, F.S.A.

Sept. 16th.—Canford Manor, by Mr. George Brownen.

All the General Excursions were well attended and very successful.

Particulars of the Sectional Lectures and Excursions are given in the Sectional Reports.

At the last Annual Meeting Sir E. Ray Lankester, K.C.B., F.R.S., was unanimously re-elected President for the second year.

The Council is much pleased to state that Sir Daniel Morris, K.C.M.G., its esteemed Chairman of Council, has consented to be nominated to the Presidential Chair for the coming year.

The Society has felt the loss of the valued services of Dr. G. E. J. Crallan, a former President, who has gone to reside in Jersey, and the removal by death of Mr. George Galpin, who took a keen interest in botanical matters.

The lease of the Society's Rooms at the Granville Chambers having expired on the 25th of March, and with the permission of the Education Committee the Society has been accommodated with quarters at the Municipal College at Lansdowne. The Council and Meeting Room is sufficiently large for most Meetings except the General, and there is sufficient room for the Library and some cases for the Botanical and Geological Collections. Further, it is in a central situation and closely adjoining the Public Library.

Sir Daniel Morris again acted as Delegate of the Society at the British Association Meeting held at Birmingham, and Dr. W. T. Ord, F.G.S., represented the Society at the Congress of the South Eastern Union of Scientific Societies at Hampstead.

The Belfast Naturalists' Field Club held its 50th Anniversary in May, when Mr. T. Michell, the Hon. Secretary, was kind enough to serve as Delegate.

The Council is pleased to announce that the South-Eastern Union of Scientific Societies, on the invitation of the Borough Council, will hold its next Congress at Bournemouth in June,

1914. The Council of the Natural Science Society will join with the Borough Council in making the necessary arrangements for the visit of this distinguished body interested in scientific matters of local interest. It is sincerely hoped that as many Members as possible with their Friends will join the Congress in its meetings and excursions and assist to make it a success. Preliminary arrangements are in course of being made and further particulars will be issued at an early date.

The Barton fossils shells, known as the Dent Collection, have been acquired by the Society and some of the more interesting specimens will be placed on exhibit at an early date. The Collection is regarded as a fine one, and it contains a few specimens of almost unique importance.

In addition to the above the following have been presented by private donors to the Geological Collection.

Miss Buckland gave a Collection of miscellaneous specimens, which formed part of Professor Buckland's Oxford Collection.

A collection of local specimens, presented by Miss Laidlay.

Fossil leaves from the Bournemouth Cliffs, given by Mr. H. Morden Bennett.

Shells from the Barton Cliffs, presented by Mr. A. Gray.

Calcite Crystals from Corfe, presented by the Rev. T. S. Ross.

Specimens of Carboniferous Limestone (Cheddar) and of Igneous Rocks (Scotland), presented by Dr. G. E J. Crallan.

And several other minor gifts.

Books and pamphlets on Geology were presented by Messrs. R. V. Sherring and I. M. Gray; Stanfield's chart of Bristol Fossils was given by the Rev. F. A. Allen; and a valuable copy of Brander's Hampshire Fossils (1766) by Mr. H. St. Barbe.

The principal donors to the Botanical Collections were the Rev. E. F. Linton, through whose kindness a valuable gift was made of the large part of the Botanical Collection of the late Rev. W. H. Purchas; some British plants from Miss Ida Roper; and Mr. Liddiard, who gave specimens of New Zealand plants.

Books and pamphlets on Botanical subjects were presented by Mr. Thos. Shepherd, Dr. Mahomed, Mr. R. V. Sherring, and Mr. Arthur Gray.

The following were the principal donors of books relating to the other sections:—

Mr. Aubrey Edwards presented 23 vols. of the Selborne Magazine.

Mr. Hugh A. Saunders gave a copy of the XXth Century Citizen's Atlas.

Mr. Henry Backhouse presented several Journals of the Alpine Club.

Miss Ida Roper gave Rubbings of 4 brasses from St. Mawgan's Church, Cornwall.

Colonel Hawley presented a Report of the work done under the auspices of the Royal Archæological Society at Old Sarum, and

Mr. H. T. Waddington a reprint from the Journal of the Royal Microscopical Society on *Chirocephalus diaphanus* and *Artemia salina*.

Early in the year the Society was affiliated to the British Geological and Mycological Societies.

The Council has become a subscriber to the Southampton Record Society, whereby it will obtain a copy of all publications issued by it during each year.

The Cotteswold Naturalist Field Club has agreed to exchange Proceedings with our Society.

The Council desires to draw the attention of Members to the Society's Library of Scientific Works and trusts that both the Library and the Collections will be fully utilised during the coming year.

For hospitality received by the Members and for permission to visit their Estates your Council desires to place on record their thanks to A. C. de La Fontaine, Esq., J.P., Sir George Meyrick, Bart., the Sherborne School Authorities, Mrs. Bosworth Smith, the Earl of Pembroke, Ernest Homer, Esq., and Lady Wimborne.

In conclusion the Council offers its best thanks to the numerous donors of botanical, geological and other specimens, to the donors of books, and to the various Lecturers and Conductors of Excursions for their services, which have been warmly appreciated by the Members and have greatly contributed to the success of the work of the Society during the past year.

Hon. Librarian's Report for 1912-13.

DURING the past year additions to the library have been made both by gift and by purchase out of the funds of the Society. The flow of generous gifts from Dr. Crallan, which had brought the library well towards its present bulk, has naturally ceased with his removal from Bournemouth. It would be a pity if the work which had thus been well started of building up a library commensurate with the activities and standing of the Society should not go forward. There is room in Bournemouth, among a group of men and women interested in science, such as our Society is, for a library of modern scientific literature. The Public Libraries do not and for some time may be unable to fill that space. The Bournemouth Natural Science Society should, as soon as its

immediate financial necessities are satisfied, proceed to equip itself, and so the town, with an adequate collection of scientific works, more particularly those bearing upon the activities of the various sections of the Society. As part of this general policy may be urged an immediate effort for the collection of as full a library of papers, reprints of lectures before local or national scientific societies and memoirs bearing upon the features and history of the district, as it is possible to obtain. Individual members of the Society can assist towards this end, according to their special interest and the richness of their gleanings for private study in the scientific literature of local interest.

Now that the Library is comfortably housed and set out, it is expected that it will be more used than during the past year, and being more used its many wants realised and gradually met.

—— W. MUNN RANKIN.

Report of the Delegate to the British Association, 1913.

SIR DANIEL MORRIS presented a Report as Delegate of the Bournemouth Natural Science Society at the Conference of Corresponding Societies at the meeting of the British Association for the Advancement of Science, held at Birmingham, September 10th—17th, 1913.

The Chairman of the Conference was Dr. P. Chalmers Mitchell, F.R.S., the Vice-Chairman Sir H. George Fordham, and the Secretary, Mr. W. P. D. Stebbing. There were present 72 Delegates of Affiliated Societies, and 21 from Associated Societies, making a total of 93.

At the opening meeting held on Thursday, September 11th, the Chairman gave an interesting address on "Utility and Selection" in Plant and Animal Life, which was listened to with rapt attention.

The following subjects, suggested by the Yorkshire Philosophical Society and the Belfast Naturalists' Field Club were discussed:—"The Relationship of Local Museums with Educational Institutions," introduced by the Rev. William Johnson, and "The best means for Preventing the Extinction of Local Species," introduced by a paper by Mr. R. H. Whitehouse. Mr. A. R. Horwood, of Leicester, also opened a discussion on "Scientific Societies and the Control of Plant Extinction."

Consideration was given to the desirability of holding the Conference of Delegates in 1914 at Havre during the meeting of the French Association for the Advancement of Science in that town. Dr. Loir, local secretary, had written to say that the principal British residents in Havre had joined a Committee for the reception of members of the British Association.

At the second meeting of the Conference, on September 16th, it was decided to accept the invitation to hold the Conference of Delegates at Havre in 1914.

List of Members.

Revised to 5th January, 1914.

* Honorary Members. † Past Presidents. A Associate Members.

Members elected since August 1st in Italics.

Members resigned since September 30th, in brackets [.....].

A

Abbott, A. J.	Strathmore, 23, Westby Road, Boscombe
[Ainsworth, Mrs.]	Corolanty, 27, Spa Road, Boscombe
Alabaster, Lady	Dil Aram, 36, Sea Road, Boscombe
Alder, Mrs.	East Grove, Lymington
Alder, Miss Evelyn	,, ,,
Aldridge, Mrs.	Denewood, 55, Alum Chine Road
Aldridge, Miss Mooring	Westover, 4, Portarlington Road
Aldridge, Miss C. Mooring	,, ,,
Aldridge, Miss E. Olive Mooring	,, ,,
Alexander, Saml. J.	Abbotslea, 5, Surrey Road
Allan, Alexr.	Bylands, Boscombe Cliff Road
Allday, J. L.	Priory Lodge, 79, Alumhurst Road
Allday, Mrs.	,, ,,
Allen, Rev. F. A., M.A.	Staffa, Wellington Road, Parkstone
Allis-Smith, Miss E.	Martello Towers, Branksome Park
Allwood, Miss C. A.	The Chimes, 5, Crabton Close Road
Anstice, Mrs. M.	Bryher, Tower Road
[Anthony, H.]	Crossways, 7, Burtley Road, Southbourne
Archer, J. W.	Windlesham, 5, Braidley Road
Archer, Mrs.	,, ,,
Armstrong, Mrs.	27, Cecil Road, Boscombe
[Armstrong, R.]	Blythe, 12, Beresford Road, West Southbourne
[Armstrong, Mrs. R.]	,, ,, ,,
Ashby, Geo.	Rosenheim, 8, Crabton Close Road
Aston, J. J.	Habberley, 6, Hamilton Road, Boscombe
Atkins, Dr. F.	Cathay, 44, Alumhurst Road
Atkins, Mrs.	,, ,,
Atkins, W.	The Hermitage, 40, Wimborne Road
Atkins, Mrs.	,, ,,
Atkinson, Miss	Berwyn, New Milton
[Atkinson, Miss Phyllis]	Pelham House, Herbert Road, Westbourne

B

Backhouse, Hy.	Yelland, 5, McKinley Road
Backhouse, Mrs.	,, ,,
Bain, Mrs.	5, Christchurch Road
Bainbridge, Surgeon-General	Vernon, Sandecotes Road, Parkstone
Baker, Miss	Sutton House, Marlborough Road
Banfield, Col. R. J. F., C.B.	Park View, 42, Poole Road
Banks, R. Y.	Egerton, 12, Portchester Road
Barlow, E. W., B.SC., F.R.A.S.	Ditton Lodge, 8, Stourwood Avenue
ABarraclough, Aug., M.A. (Cantab), F.R.G.S.	56, Richmond Wood Road
Barratt, J. Hayes	Brundon, 2, Surrey Road
Bartlett, H. F. D., F.E.S.	1, Myrtle Road, Richmond Park

[Batley, Dr.]	Kenilworth, 35, Stour Road, Christchurch
Bayley, Miss D. E.	Dene House, West Hill Road
Beck, Rd.	Red Lodge, 49, Portchester Road
Bell, T. G., M.D.	38, Poole Road
Benison, F.	Aldborough House, 14, Rosemount Road
Benison, Mrs.	" "
Bennett, Miss Bessie	West View, 31, Churchill Road, Boscombe
Bennett, Miss E. C.	Bonavista, 19, Boscombe Spa Road
[Bennett, G.] deceased	Sigwells, 20, Belle Vue Road, Southbourne
[Bennett, Mrs.]	" " "
Bennett, H. Morden	Manor Lodge, Manor Road
Bilton, Miss C. E.	Dilkhush, 25, Parkwood Road, Boscombe
Blackall, Miss E. E.	Leamfield, Castlemain Road, Stourwood
Blackett, C. H.	Rosapenna, 16, McKinley Road
Blackett, W. Eggleston	Blanchland, 21, McKinley Road
Blake, L. E.	Kingsland, Ravine Road, Canford Cliffs
Blake, Mrs.	" " "
Blosse, Rev. R. C. Lynch	Hawthorn Dene, 10, Cavendish Road
Blosse, Mrs.	" "
Blosse, Miss Emma K. Lynch	Berkeley, 3, Rushton Crescent, Wimborne Road
Blosse, Miss Cecilia M. Lynch	" "
Blundell, Miss M. J.	Oakley, 17, Carysfort Road, Boscombe
*Bond, F. Bligh, F.R.I.B.A.	Glastonbury
Brazier, J. J.	East Hill, 32, Southcote Road
Brett, G. H.	Harbledown, 5, St. John's Avenue, Boscombe
Brett, Mrs. E. K.	" "
Brett, Miss J. E.	" "
Brett, Miss K. M.	" "
[Briant-Botley, Mrs.]	Studlands, 16, Wharncliff Road, Boscombe
[Brindley, Rev. R. B.]	Ellington, Foxholes Road, Southbourne
Brittain, Rev. E. R.	St. Andrew's House, Bennett Road
Brittain, Mrs.	" "
[Broadhead, Miss Florence E.]	Chine Grange, 8, Chine Crescent
Brownen, Geo., F.C.S.	Talnas, Grove Road, Christchurch
Brownen, Mrs.	" " "
Brumell, Geo., A.R.I.B.A.	Maori, Richmond Park Avenue
Brumell, Mrs.	" "
Brutton, Miss Jessie	Southernwood, 108, Southbourne Road
Bulfin, Ignatius, B.A.	The Den, 26, Knole Road
Bulfin, Mrs.	" "

C

Cameron, Miss	Little Forest House, 19, Bath Road
Capper, Thos., M.A., B.SC.	Ropley, Stirling Road
Carus-Wilson, C., F.R.S., Edin., F.G.S.	Altmore, Waldegrave Park, Strawberry Hill, Middlesex and Royal Societies' Club, S.W.
Castle, Vice-Admiral	Micklehurst, 11, Argyll Road, Boscombe
Castle, Miss V.	" " "
Cavit, C. G.	Marly, 10, Argyll Road
ACHaffey, W. J.	294, Windham Road
ACHambers, D.	84, Victoria Road
Chandler, S. Whitty, B.A.	St. George's, Cecil Road, Boscombe
Chandler, Mrs. Whitty	" "
Chapman, F. F.	Penrhyn, Chessel Avenue, Boscombe Manor
Chapman, Miss	"
Charsley, Mrs. Julia E.	Camborne, Belle Vue Road, Southbourne

[Cherry, Mrs.]	Merridale, 11, Westby Road, Boscombe
Chesters, Rev. L. M.	Nantissa, 6, Suffolk Road
Chidell, Miss F. K.	Nairn, 8, Suffolk Road South
ACHILVER, Miss Kathleen M.	79, Richmond Park Road
ACHISMAN, Miss E. M.	Heatherlea, 11, Cowper Road, Moordown
Chittenden, H.	Neavetta, 20, Waverley Road
Clark, Walter Child	Michelgrove House, Boscombe
Cocks, Lt.-Col. H., M.B., *late* R.A.M.C.	Whitekirk, Belle Vue Road, Southbourne
Coddington, E. F.	St. Frideswide, 94, Southbourne Road
Coles, Dr. A. C.	York House, 3, Poole Road
Collins, W. F.	Vellore, Overcliff Drive
Collinson, Miss K.	St. Cleather, 42, Wimborne Road
Compton, Rev. D. G.	The Downs, Clifton Road, Southbourne
Cooke, F. I.	Corona, Annerley Road
Cooper Ernest	100, Old Christchurch Road
Cooper-Dean, Mrs.	The Old Vicarage, Pokesdown
Cooper-Dean, Miss A. E.	Littledown, Christchurch
Cooper, Mrs. J. Omer	Calcot, 50, Westby Road, Boscombe
Cooper, J. Omer	,, ,, ,,
Cooper, Wilfrid Omer	,, ,, ,,
Cooper, Rev. W. H. Windle, M.A., F.R.G.S.	The Birks, 2, Branksome Wood Road
Cornthwaite, H.	5, Town Hall Avenue
Cotes, H. V. M.	Meyrick Park House
Cowie, Dr.	Bonaccord, Westminster Road
†Crallan, Dr. G. E. J., M.A., M.B., M.R.C.S.	Gouray Lodge, Gorey, Jersey, Channel Islands
Crespi, Dr.	Cooma, Poole Road, Wimborne
Crowther, Miss Violet	Shelbrook, Brunstead Road, Westbourne
Curme, Decimus	Child Okeford, Blandford
Curme, Mrs.	,, ,,
Curtis, W. Parkinson, F.E.S.	The Square

D

Dacombe, J. M. J.	27, Holdenhurst Road
Davenport, Miss C.	Torvaine, Parkstone
[Davys, Rev. S. D.]	Rosebank, 39, Lansdowne Road
Day, Miss	Fairhurst, Barrack Road, Christchurch
de Castro, Geo., M.R.C.S. (Eng.)	Sunnydene, 76, Drummond Road
de Castro, Mrs.	,, ,,
de Paiva, R. A.	San Remo, 13, Carysfort Road
de Paiva, Mrs.	,, ,,
*Dixon, Dr. J. R. L.	Torbay House, Torbay Road, Paignton
Dodd, Dr. W. H.	Maybrook, Wimborne
Dodshon, Edwin	Lloyds Bank Chambers
Druitt, Herbert	15, High Street, Christchurch
Druitt, Ald. J., J.P.	Avebury, 10, Madeira Road
Druitt, Robt.	Carfax, Christchurch
Dudding, Mrs.	22, New Park Road, West Southbourne
Dunning, Mrs.	The Homestead, 21, St. Clement's Road

E

Earle, Dr.	The Wyke, Brunstead Road
Edwards, Aubrey	The Birches, Penn Hill Avenue, Parkstone
Eiloart, Miss	Glengyle, Chester Road, Branksome Park
Ellis, Hy. J.	Chesterford, Richmond Park Avenue

Elwes, Capt. G. R., J.P.	Bossington, 14, Knyveton Road
Evans, P., M.A.	Saugeen, 30, Derby Road
[Evens, T., M.INST.C.E.]	Pobbles, Southwood Avenue, Stourwood
[Evens, Mrs.]	,, ,, ,,

F

Fairles, Gustavus W.	Bank House, Alexandra Road, Parkstone
Farrington, Miss	Canterbury House, Marlborough Road
AFirbank, Miss	5, Buchanan Avenue
[Foster, Miss Ada]	Hendra, 2, Studland Road
Foster, Miss Amy	,, ,,
Fowler, Miss R. M.	Rushcot, 8, St. Winifred's Road
[Fowler, Miss V. M.] deceased	,, ,,
Fraser-Hird, Rev. F. M.A.	Eaglehurst, 16, Parkwood Road
Frean, G. M.	Cranicombe, Branksome Avenue
Frean, Mrs.	,, ,,
Freeman, Miss Emily	Corona, Annerley Road
French, J. M.	The Gables, 12, Wharncliff Road
Frewin, Alfred	Rowherne, 43, Branksome Wood Road
AFunnell, Miss B. E.	Kelso, 5, Campbell Road, Boscombe
Furlong, R. O'B., C.B., M.A.	Maesbury, 3, Cavendish Road

G

[Galpin, G.] deceased	Clarendon Court, Clarendon Road
Gardiner, Miss F. M.	The Rosery, 105, Alumhurst Road
Gardner, Dr. W. T.	Netherall, 27, Poole Road
[Gardner, W. Temple]	Alexandra Road, Parkstone
[Gardner, Mrs. Temple]	,, ,,
[Garland, Dr. Albert I. L.R.C.P., Edin., M.R.C.S. (Eng.)]	The Moyne, 15, Boscombe Spa Road
Garrett, T. R. H., M.A., F.G.S., F.R.G.S.	16, Queensland Road, Boscombe
Gaussen, Miss Elsie	Ardnagreina, 3, Stourwood Road
George, Arthur Durancé	Alderholt, 6, Clarendon Road
Gibbons, Miss Ada	Ambleside, Frankston Road, West Southbourne
Gibson, Mrs. Alice	Hillcote, Constitution Hill. Parkstone
Gissing, Admiral C. E.	Homestead, Queen's Park South Drive
[Going, Miss F.]	St. Paul's House, Parkstone
Goodall, T. B., F.R.C.V.S., F.L.S.	Purewell Cross, Christchurch
[Gorringe, Rev. P. R.]	124, Richmond Park Road
Gorringe, Mrs.	,, ,,
Graham, F. A.	21, Beaulieu Road
Grange, Dr. W. D'Oyly	11, McKinley Road
Gray, A.	Woodville, 26, Melville Road, Winton
Gray, Geo. W.	Darena, 15, Wellington Road
Gray, Mrs.	,, ,,
Gray, Joseph Wm., F.G.S.	6, Richmond Park Crescent
Griffiths, Capt. David, S. & T. Corps, I.A., retired	Bakrota, Belle Vue Road, Southbourne
Grindley, Miss E. J.	Chatfield, Parkstone
AGuest, G., B.A.	St. Paul's School
AGuy, Miss	,,

H

[AHamblock, Miss Emily L.]	Castleton House, 16, Southsea Terrace, Southsea

Hamilton, G. G., M.B., F.R.C.S., F.R.H.S.	Boscombe Place
Hamilton, Mrs.	,,
Hamilton, Major Claude	Westholme, Foxholes Road, Southbourne
Hammer, Miss A. G.	66, Lowther Road
[Handley, Rev. S. B.]	Copthorne, Heathwood Road, Winton
Hannah, Rainsford	Stanmore, 49, Branksome Wood Road
AHarding, Miss	Alma Road Council School
Hardwick, Philip	21, Commercial Road
Harkness, Mrs. J. C.	Hawkley, 27, West Cliff Road
Harris, Miss K.	Trescott Grange, Harvey Road, Boscombe
[Harrison, Miss E. Margaret, LL.A., L.C.P.]	West Heath School, Belle Vue Road, Southbourne
Harrison, Henry	Southlea, Durley Road, West Cliff
Harrison, Miss Nora B., F.R.H.S.	Sandigate, Stourcliff Avenue, West Southbourne
Hawker, Miss	Kingsbere, Meyrick Park Crescent
[Hayllar, J., J.P.]	Redholme, 14, Cambridge Road
[Hayllar, Miss]	,, ,,
Haylock, Dr. S. J.	Balsham, Clifton Road, Southbourne
Hayward, Hy.	Kia Ora, St. Albans Avenue
Heaton, Guy, M.A.	St. David's, 51, West Cliff Road
Henslow, Rev Professor G., M.A., F.L.S., F.G.S.	Danehurst, 40, Branksome Wood Road
Heywood, Col. J. M.	Sutherland Hall, South Cliff
Hill, S. McCalmont, D.C.L.	The Priory, 20, Argyll Road, Boscombe
Hinton, Miss	Welcombe, 1, Argyll Road, Boscombe
Hippisley-Smith, Rev. A.	Knowlton House, 22, Surrey Road
Hoare, Mrs. Annie	Westdale, 7, Cambridge Road
Holmes, C. F.	Brackenwood, 37, Southern Road, West Southbourne
Holmes, Mrs.	,, ,, ,,
Holmes, Miss M. A.	4, Beaufort Road, West Southbourne
Holmes, Miss S. C. M.	,, ,,
Homer, L. V. C.	Carron, 54, Southcote Road
Honeyman, G.	Stormont, Milton Road
Honeyman, Mrs.	,, ,,
Honeyman, Miss M. W.	,, ,,
Horton, Rev. Canon R.	St. Mary's Lodge, Guildhill Road, Southbourne
Hudson, F.	Peñarol, Parkstone
Hudson, Mrs.	,, ,,
[Hughes, D.]	Meran, 49, Wellington Road
Hunter, H. J.	Castle Bar, 32, Crabton Close Road
[Hunter, Mrs.]	,, ,,
[Hurry, Miss G. M.]	Ingarth, 3, Twynham Road, Southbourne

I

Ibbett, F. W.	Central Education Office, Yelverton Road

J

James, Thos. Bath	Trevenen, Howard Road
James, Mrs.	,, ,,
James, Miss G. Gladys	,, ,,
Jeffery, T. J. P.	Meldon, Ormonde Road
Jeffery, Miss Ruby	,, ,,
Jeffery, Miss E. S. M.	The Haven, 38, Sea Road

Jennings, Miss C. E.	Edenhurst, Sandbanks Road, Parkstone
[Jeremy, Mrs.]	Whalley Grange, 10, Portarlington Road
[Jeremy, Dr. Mary]	4, Richmond Hill
Jermyn, F. L.	61, Old Christchurch Road
[Joachim, Mrs. Hy.]	Solheim, Milner Road
[Joachim, Miss Dorothy]	,, ,,
AJones, W.	Council School, Boscombe
Jones, W.	254, Old Christchurch Road

K

Kay, A. J.	Winsgarth, 141, Lowther Road
Kaye, J. E.	Tynedale, 38, Portchester Road
[Kaye, W. J.] deceased	Birk House, 3, Wollstonecraft Road
Keevil, W. C.	Eglington, Kinson, Bournemouth
Keighley, Miss	6, Stourcliffe Avenue, West Southbourne
Kent, Geo. G.	Ballinhassig, Southwood Avenue, West Southbourne
Keogh, Duncan	The Warren, 13, Richmond Wood Road
Keogh, Mrs.	,, ,,
Kerby, Miss L.	Shelford Lodge, Southwood Avenue, West Southbourne
Kidner, Hy., F.G.S.	194, Shelborne Road
Killick, H. F.	Rawdon, 9, Marlborough Road
Kerby, Miss L.	Inglewood, Richmond Park Avenue

L

Langley-Smith, W.	Alumhurst Tower, 115, Alumhurst Road
Langley-Smith, Miss	,, ,,
Langley-Smith, Miss R.	,, ,,
Lattey, F.	Alyngby, Stourcliffe Avenue, Stourwood
Leach, Miss Frances	The Five Ways, Parkstone
Leigh, Miss	Wood Lodge, Penn Hill Avenue, Parkstone
Le Jeune, Hy.	St. Ives, Ashley Road, Upper Parkstone
Lendrum, Miss A. M.	c/o Mr. de Paiva
Lendrum, Miss E. A. E.	,,
Letcher, Mark Jameson	Gwestfa, 18, Richmond Wood Road
Lewis Miss Constance F.	6, St. John's Avenue, Boscombe
*Liddiard, Jas. E., F.R.G.S., M.N.G.S. (U.S.A.)	Rodborough Grange, 66, West Cliff Road
Lilley, W.	St. Agatha's, 14, Owls Road, Boscombe
Lilley, Mrs.	,, ,, ,,
*Linton, Rev. E. F., M.A.	Edmondsham, Salisbury
Lucas, Arthur	Croftmoor, 23, Dean Park Road
Lucas, Arthur, Junr.	Highfield, Richmond Park Avenue
Lupton, Miss	Bolingbroke, Knole Road
Lyon, Claude	Shalimar, Wilderton Road, Branksome Park
Lyon, Mrs.	,, ,, ,,

M

Macalister, R., M.INST.C.E.	Somerled, 29, Meyrick Park Crescent
Macalister, Mrs.	,, ,,
McBean, Miss J.	Inglenook, 29, Parkwood Road
AMcBean, Miss S.	Froebelheim School, 47, Lowther Road
McLorg, Miss Adeline	Tre Vean, Colville Road, Boscombe Park
McLorg, Miss F. M.	,, ,, ,,

AMackay, Miss	St. Andrew's School, Malmesbury Park
Mackelvie, J. Mc Intosh	Cliff Cottage, Boscombe Manor Park
Mackelvie, Mrs.	,, ,,
Mackelvie, Miss Esther H.	,, ,,
Mackelvie, Miss Doris	,, ,,
Mackenzie, Dr. Ridley	Heather Bank, Richmond Hill
Mahs, Miss E. M.	Castle Court, 23, Boscombe Spa Road
Mann, W. P., B.A.	38, Crabton Close Road
March, H. Colley, M.D., F.S.A. M.R.S.A.I., F.A.I.	Nethergrove, Portesham, Dorchester
*Markwick, Col. E. E. C.B., F.R.A.S.	Filchin, Havant, Hants
Martin, Miss Florence	32, Southbourne Road
Martland, Dr. T.	Standish House, Fitzharris Avenue
[Martland, Mrs.]	,, ,,
Mate, Ald. C. H., J.P.	Elim, 3, Surrey Road South
Maude, W. C., J.P.	Brackenwood, Gervis Road
May, Alfred J., I.S.O.	Boa Vista, Talbot Road
May, Mrs.	,, ,,
Maybery, Joseph, J.P.	Langley Dene, 55, Wellington Road
Maybery, Mrs.	,, ,,
Michell, Theo., M.INST.C.E.	Trewirgie, 37, Christchurch Road
Michell, Mrs.	,, ,,
Miller, Joseph L.D.S., R.C.S. (Edin.)	Wenonah, 37, Poole Road
Miller, Mrs.	,, ,,
Millward, A. H.	St. Aubyn's, 201, Holdenhurst Road
Millward, Mrs.	,, ,,
Montgomrey, Miss L. F. M.	Everton, 49, Westby Road
Moon, Miss	c/o Mr. Maybery
Moon, P. G. G., F.C.S.	Hill Croft, Alexandra Road, Parkstone
Moore, F. W.	Goathland, Tower Road, Branksome Park
Moore, Montie S.	,, ,,
Moorhead, Dr.	Imperial Hotel
*Morris, Sir Daniel, K.C.M.G., J.P., M.A., F.L.S.	14, Crabton Close Road
Morris, Lady	,, ,,
Morton, Miss C. I.	Castle Court, 23, Boscombe Spa Road
Moss, Miss	The Grange, 52, Westby Road
Mossop, A. G., D.P.H., M.R.C.S., etc.	19, Wimborne Road

N

Neale, J., B.A.	36, Beaufort Road, West Southbourne
Neale, Mrs.	,, ,,
Neale, Miss D.	,, ,,
Neale, Miss C. M.	14, Carysfort Road, Boscombe
Neave, Mrs.	Lingdale, 73, Lansdowne Road
Neave, Miss	,, ,,
[Nelson, Mrs. Beatrice]	Northwood Lodge, 61, Wimborne Road
Neve, Miss	Merridale, 11, Westby Road
Nicholson, Mrs.	Ashfield, 7, St. Clement's Road
Noble, Miss E. I.	Castle Court, 23, Boscombe Spa Road
Norman-Hill, Mrs.	Yelvertoft, 50, West Cliff Road
[Nunn, Dr.]	Gestingthorpe, 3, Hayes Avenue
Nunneley, Miss	Moorlands, 32, Portchester Road

O

Offley-Shore, Miss Janet D.	Wharncliffe, Queen's Road, Bournemouth Road, Parkstone

[O'Hara, Col. W., I.M.S. (Ret.)]	Woodcock House, 32, Florence Road, Boscombe
Oke, A. W., B.A., LL.M., F.G.S., F.S.A.	32, Denmark Villas, Hove, Brighton
Old, Robt. H.	5, Westover Colonnade
[Oliver, C. R.]	Ambleside, 33, Parkwood Road
Oliver, Mrs.	,, ,,
Oliver, Mrs. E.	Teviotdale, Milton Road
Ord, Dr. W. T., F.G.S.	Greensted, 14, Madeira Road

P

[Page, T.]	Trevissome, Parkstone Road, Poole
[Page, Mrs.]	,, ,, ,,
[Page, Miss P.]	,, ,, ,,
Pain, Miss M. T.	Membury, 52, Wellington Road
Painter, Hubert, B.SC., F.C.S.	29, Talbot Road, Winton
Painter, Mrs.	,, ,,
Parish, Miss	Bentley Lodge, 9, Hengist Road
Parmiter, C. J.	Milton House, 29, St. Leonard's Road
Parmiter, Mrs.	,, ,,
Parmiter, P. J.	,, ,,
Pate, Rev. J.	Spencer House, Constitution Hill, Parkstone
Pechell, Sir A. Brooke, Bart.	c/o Messrs. Holt and Co., 3, Whitehall Place, S.W.
[Pechell, Miss]	,, ,,
Pestell, Miss	Engelberg, Surrey Road
APettifor, Miss C. B. B.SC. (Lond.)	Towerfield, 28, Poole Road
Phillips, Mrs.	43, Alumhurst Road
Philpott, C. C.	Hinxhill 68, Westcliff Road
Philpott, Mrs.	,, ,,
APovah, Edwin	Woodseat, Southern Road, Stourwood
Preston, Donald W.	Bank Chambers, Yelverton Road
Price, Miss Annie N.	Shelford Lodge, Southwood Avenue, West Southbourne
APritchard, Miss M. E.	Eildon, Langdon Road, Parkstone
Pugh, Miss	The Albynes, 9, St. Winifred's Road
Pullman, A.	Seacroft, Cliff Drive, Southbourne
[Pullman, J.]	The Knollsea, Lilliput, Parkstone
Pyemont, Miss Rosa U.	32, Hawkwood Road, Boscombe

R

Rankin, W. Munn, M.Sc (Leeds), B.Sc. (Lond.)	Municipal College, Lansdowne
†Ransome, Dr. A., F.R.S.	Sunnyhurst, 7, Dean Park Road
Ransome, Miss	,, ,,
*Rayner, J. F.	Ivy Bank, Highfield, Southampton
Reed, F.R.C., M.A., F.G.S.	Gaultier, Madingley Road, Cambridge
**Reid, Clement*, F.R.S., F.L.S., F.G.S.	Milford-on-Sea
Reid, Mrs. G. A.	Sticklepath, 2, Durley Road
Reid, R. N. H., M.INST.C.E.	Sunnifielde, Haven Road, Canford Cliffs
Reid, Mrs.	,, ,, ,,
Reid, Leslie	,, ,, ,,
Robertson, Mrs.	Struan, Alum Chine Road
Rogers, Forster	Capri, Richmond Park Avenue
*Rogers, Rev. Moyle	Chetnole, 11, Grosvenor Road

Rogers-Barns, Miss	Bevois Cottage, 25, King's Park Road
Rooper, Miss C. Agnes	Pen Selwood, 13, Gervis Road East
Ross, Rev. T. S.	Lennox, Foxholes Road, Southbourne
Ross, Col. W. H.	Ambleside, 9, Dean Park Road
Rowe, Mrs. R. Vidal	Viwa, 9, McKinley Road
Rudkin, Miss F.	Ivel Cottage, 25, Hamilton Road, Boscombe
Rumsby, Mrs. S.	Ennisfall, Fitzharris Avenue, Charminster Park
[Rumsby, Walter Saml., P.A.S.I.]	Winchester House, Fir Vale Road, Bournemouth
Rutherfurd, C. R.	South Dene, 1, Groveley Road
Rutherfurd, Mrs.	,,
Rutter, G. H., M.B.	Roxbury House, 22, Poole Road
[Rutter, Mrs.]	,,
Ryde, Kenneth A.	47, St. Swithun's Road

S

St. Barbe, H.	Okehampton, 3, Milton Road
St. Leger, Col.	Christchurch Lodge, 12, Rosemount Road
Salkeld, Dr. Chas.	Glen Court, 32, Poole Road
Salkeld, Mrs.	,, ,,
Salmon, T. E.	Mon Abri, 14, Herbert Road
ASaunders, Hugh A., B.A., F.R.G.S.	Brookfield House, Swanage
Saunders, Miss L. Matta	Pine Cottage, Chester Road, Branksome Park
Savage, Miss E. E.	41, Drummond Road
Scarlett, Miss A.	Fermoy, St. Alban's Avenue
Scarlett, Miss K.	,, ,,
Scarlett, Miss M.	,, ,,
AScattergood, J.	Alma Road Council School
Scott, J. H., M.E., M.I.M.C.E.	Skiddaw, Talbot Hill, Winton
Scott, W. H., M.A.	Hendall, Westminster Road
Searle, A. H.	The White House, Grove Lane, Christchurch
[Sedgfield, Miss C. B.]	Hartmoor, 11, Alumdale Road
Sells, H. Martin	Pearlhaven, Canford Cliffs
Sherring, R. V., F.L.S.	Hallatrow, near Bristol
Sherring, Miss O. L.	,, ,,
Shillitoe, Dr. R.	Bancroft, Pinecliffe Avenue, Stourwood
[Shillitoe, Miss Mary Monica]	Ardvernis, 3, Richmond Gardens, Richmond Hill
[Smith, Francis F.]	5, Castlemain Road
Smith, Rev. Philip H.	Spinney Hill, 44a, Grosvenor Gardens, Boscombe
[Smyth, Miss E. Watson]	Ingarth, 3, Twynham Road, Southbourne
Smythe, J. H. Ralph, J.P.	Willstead, 22, Cavendish Road
Solly, Rev. Hy. Shaen, M.A.	Southcote, Alexandra Road, Parkstone
Southby, Miss E. H.	Twyford Lodge, 17, Cavendish Road
[Sowter, Miss]	c/o Mrs. Hy. Joachim
Spencer, J. F.	Glenthorne, 73, Richmond Park Road
Spencer, Miss W.	Verwood, 16, Lowther Road
Spencer-Bower, Anthony, C.E.	Lea Royd, 48, Westby Road, Boscombe
Spencer-Bower, Mrs.	,, ,,
Spriggs, A. T.	The Bryn, 95, Belle Vue Road, Southbourne
Spriggs, Mrs.	,, ,,
Stapleton, the Hon. Mrs.	55, Parkwood Road, Boscombe
Stapleton, Miss	,, ,,
[Stevenson, E. A.]	Northwood, 16, Windermere Road

Stokes, R.	Laverstock, Cliff Road, Boscombe
[Stokes, Norman]	,, ,, ,,
Stuart, C. M.	Morlais, Milton Road
Stuart, Mrs.	,, ,,
Stuart, Miss	,, ,,
Sutton, H.	Ravenshall, 2, Chine Crescent Road
Swain, H. E.	Sorrento, Studland Road
Swallow, E.	Westridge, Sandbanks, Parkstone
Sworn, Mrs.	Normandale, 63, Lansdowne Road
Sykes, Chas. Ewd.	Oak Lodge, Talbot Avenue
Sykes, Mrs.	,, ,,
Sykes, Miss	,, ,,

T

Tanner, Miss Nellie	Parkside, 191, Richmond Park Road
Tatchell, Leonard	23, Arcade
Thomas, J.	c/o Bright's Stores
Thomas, Miss Lilian	Speedwell, Parkstone Road, Poole
Thompson, Rev. G., M.A.	Highbury, 4, Bodorgan Road
Thompson, C. R.	Holmwood, Castle Hill, Parkstone
Thompson, Miss Alice	,, ,, ,,
Thompson, Miss A. C.	,, ,, ,,
Thompson, Miss Ellen	,, ,, ,,
Thomson, Dr. J. Roberts, J.P.	Monkchester, 17, Manor Road
Thomson, Mrs.	,, ,,
Thomson, Matthew	Fircliff, 29, Studland Road
Tickell, Miss S. M.	Boscombe Lodge, 12, Boscombe Spa Road
Toppin, Mrs.	Westminster Cottage, Branksome Park
Towsey, Miss E. L.	Moseley, 20, Owls Road, Boscombe
Treeby, Miss C. S.	Wyvenhoe, 7, Stourwood Road
ATroath, Walter	55, Chatsworth Road
Tucker, Mrs. E. M.	Boscombe Cottage, 18, Wharncliffe Road
Tunnard-Moore, J. C., J.P.	Dunedin, 2, Darracott Road, Boscombe Park
Turner, J. E.	Bramley, Surrey Road

U

Usherwood, Rev. Canon	Bagdale, Parkstone

V

Veale, Miss Alice G.	Pengelly House, 3, Beaulieu Road
Veale, Miss Bertha	,, ,,
Veale, Miss Clara M.	,, ,,
Veale, Miss L. H.	,, ,,
Veale, Miss Mary Christina	,, ,,
Vernon, Dr. A. H.	1, Carnarvon Crescent, Boscombe
Vipan, Miss Dora	St. Michael's Vicarage, West Hill Road

W

†Waddington, H. J., F.L.S.	Moreton, 107, Lowther Road
[Waldron, Miss]	Benvenuto, 15, Portarlington Road
Waldron, Miss F.	,, ,,
[Wallace, Dr. Alfred Russel O.M., *deceased*]	Broadstone, Dorset
Wallace, Wm. G.	,, ,,

Wallis, Mrs. Evelyn	Gordon Hotel, Southbourne
Walter, Mrs. G. P.	Rusholme, 23, McKinley Road
Warr, Miss Ada	Cottesmore, Pokesdown Hill
Waters, A. W., F.L.S., F.G.S.	Alderley, 2, McKinley Road
Waters, Mrs.	,, ,,
Watson, J. J.	Hill View, Archway Road, Branksome
Watts, Col. Sir Wm., K.C.B.	The Priory, 53, Branksome Wood Road
Weaver, Miss	Sutton House, Marlborough Road
Webster, Rev. T.	Devonia, 2, Chatsworth Road
Webster, Mrs.	,, ,,
Welby, Rev. A. A.	Doveridge, 14, Landseer Road
Welby, Miss A. B.	,, ,, ,,
Wells, H. B., F.R.M.S.	Stalham, 16, Studland Road
Wells, Mrs.	,, ,,
Westwood, Miss	Ambleside, 12, Frankston Road, West Southbourne
Wetherell, Miss	Triana, 21, Harvey Road, Boscombe
Whiting, Albert	Rozel, Pinecliffe Avenue, West Southbourne
Wilkinson, Mrs.	Mon Repos, 36, Grosvenor Gardens, Boscombe
Willes, W. A.	Elmwood, Cranborne Road
[Williams, Rev. Richard]	Kingsworthy, 22, Church Road, Southbourne
Willis, Col. Legge	Norwood, 21, Grand Avenue, West Southbourne
Wood, Samuel, F.C.A., M.INST.G.E.	Beverley, 27, Grand Avenue, West Southbourne
Wood, Miss	,, ,, ,,
AWoodhouse, W. J., A.C.P.	35, Chatsworth Road, Malmesbury Park.
Woollacott, J. C.	Solent View, 79, Belle Vue Road, Southbourne
Wray, Captain C. A.	Ards, Talbot Avenue
Wray, Miss	,, ,,
Wray, Miss D.	,, ,,
Wray, Miss W.	,, ,,
Wright, Rev. T. Russell	Mountside, 38, Westbourne Park Road
Wyatt, Miss H.	20, New Park Road, West Southbourne
Wyatt-Roberts, C.	Woodmansterne, Foxholes Road, Southbourne
Wyatt-Roberts, Mrs.	,, ,, ,,

Y

Yates, R. P.	Woodmanton, 35, Wellington Road
Yates, Mrs.	,, ,,
Yates, Miss Ione	,, ,,
Yates, T. A.	,, ,,
Yeatman, Archibald	112, Old Christchurch Road

RULES OF THE

Bournemouth Natural Science Society.

Amended February 5th, 1912.

Title

1.—The title of the Society shall be THE BOURNEMOUTH NATURAL SCIENCE SOCIETY.

Objects

2.—The objects of the Society shall be the promotion of the study of Science in all its branches, by means of Lectures, Field Meetings, the Reading and Discussion of Papers, and the formation of Sections of its members devoted to any particular branch of the Society's work, or by any other means that the governing body of the Society shall deem advisable.

3.—The Society shall encourage the making of reports on any plant, animal, or object of interest, and where the Society may deem it necessary, shall take such steps as may be advisable to secure any such plant, animal, or object of interest from injury, extinction or destruction.

Members

4.—The Society shall consist of Ordinary, Life, Associate, and Honorary Members.

Council

5.—There shall be a Council of the Society consisting of the Hon. Treasurer, Hon. Secretary, Hon. Assistant Secretary, Assistant Secretary, the Vice-Presidents who have filled the office of President, the Hon. Librarian, the Chairmen of Sections and eight elected Members.

The Council shall have the general management of the Society. At all Meetings of the Council, five shall form a Quorum. The Council shall elect their own Chairman and Deputy-Chairman for the Year, and shall have power to fill up any vacancies in their number which may occur from time to time. The Council shall have power to appoint Committees to deal with any business that may be delegated to them.

The Chairman, or in his absence the Deputy Chairman, at all Meetings of the Council shall have an original and a casting vote.

The Council shall have the control of the Funds of the Society.

Executive Officers

6.—The Executive Officers of the Society shall consist of the Chairman and Deputy Chairman of Council, Hon. Treasurer, Hon. Secretary and one or more Assistant Secretaries.

7.—The Ordinary, Life, and Associate Members of the Society shall be proposed by an existing Member, and seconded by another existing Member, and notice shall be sent to one of the Secretaries of the Society of the names and addresses of the nominee, and the names of the proposer and seconder. Any such proposed new Member shall be voted for at the next ensuing Council Meeting, and if two-thirds of the Council present and voting shall vote for the proposed new member, such candidate shall become a Member upon payment of the Annual Subscription, and shall receive a card of membership (not transferable) entitling him or her to attend the Meetings of the Society. Members joining during August and September shall be given a card of membership to September 30th of the following year.

Ordinary Members.

8.—Ordinary Members shall pay an Annual Subscription of Ten Shillings, due on the first day of October in each Year. The Annual Subscription for Adult Members of the same family, not exceeding four and residing in the same house, shall be Twenty Shillings, each Member being elected in the usual manner and each receiving a card of membership.

Life Members. 9.—The Subscription for Life Members shall be Five Guineas. Any Ordinary Member who shall have commuted his Subscription, as provided for in this Rule, shall become a Life Member, but shall not by reason thereof have any different rights from those of an Ordinary Member.

Associate Members. 10.—Associate Members are those who by payment of an Annual Subscription of Two Shillings and Sixpence are entitled to attend all the General Meetings and Excursions of the Society. They also have the privilege of attending the Meetings and Excursions of one particular Section they may select at the time of their Election, or at the commencement of each Session, their choice being notified by them to the Hon. Treasurer. The following are entitled to become Associate Members on Election by the Council:—

(a) Teachers in schools who are still engaged in the active duties of their profession.

(b) Persons, who in the opinion of the Council, although unable to pay the fee for full membership, are by their acknowledged scientific tastes or attainments, likely to prove useful working Members of the Society.

On further payment of Two Shillings and Sixpence Associate Members are admitted to the Meetings and Excursions of all the Sections.

Associate Members shall have no power of voting on the affairs of the Society, or of holding office.

Honorary Members 11.—Any person who is either distinguished in Science or has rendered any special service to the Society, may be elected an Hon. Member. Such Hon. Members shall be proposed and elected in the same way as Ordinary Members.

Visitors 12.—Any Visitors introduced by a Member or producing a Member's card, may be admitted to any Meeting or Excursion of the Society on entering their names and that of the introducing Member in the Society's Visitors' Book. Such privilege not to be granted more than twice to any one person in each Session.

On the recommendation of the Council or Committee authorised by it, Visitors to Bournemouth desirous of attending the Meetings or Excursions of the Society, may obtain a ticket of admission for the Winter or the Summer Meetings or Excursions at a charge of Seven Shillings and Sixpence. Application to be made to the Hon. Secretary for submission to the Council or Committee authorised by it.

13.—Any Members whose subscriptions are unpaid at the end of the financial year (September 30th), on notice to that effect in writing having been given to them by the Hon. Treasurer, shall be reported to the Council, who shall have the pwoer of removing their names from the list of members.

14.—Resignations should be in writing, and addressed to one of the Hon. Secretaries, and until such are received by them, Members remain liable for their subscriptions.

15.—The power of expulsion of a Member from the Society for objectionable conduct shall be vested in a General Meeting of the Society, provided the Council has caused special notice to be given on the circular convening the Meeting, and that two-thirds of those present and voting agree thereto.

16.—The Council shall arrange all Lectures, Papers, Demonstrations and Exhibitions of Specimens, etc., both for the General and Sectional Meetings of the Society, and shall decide upon all General and Sectional Excursions.

Sections

17.—The Council shall have power to form any Section or Sub-Section, to consist of not less than six Members, for the study of any special subject which the Council may deem within the scope of the Society's work. They shall annually appoint the Chairman of any such Section or Sub-Section on the nomination of that Section or Sub-Section.

A Section shall consist of those Members who attend in each year not less than three meetings of such Section.

The Chairman of each Section shall appoint a Secretary, who in addition to the ordinary secretarial duties shall keep a list of the Members of the Section.

Sectional Meetings

18.—Each Sectional Chairman shall be responsible for the preparation and arrangement of each Sectional Meeting and Exclusion, and shall submit details of the same to the Hon. Secretary for submission to the next ensuing Meeting of the Council. He shall submit accounts of costs incurred by him to the Hon. Treasurer, after each Meeting or Excursion, who shall lay the same before the Council at their next ensuing Meeting. At the first Meeting of each Section or Sub-Section in the Year, after the Annual Meeting, such Section or Sub-Section shall nominate its Chairman.

19.—A book for each Section shall be provided by the Secretaries to be kept at the Society's Room; each Chairman of Section, or his Secretary shall enter therein an account of each Meeting, with number of Members attending, and notes of any matters of interest observed or discussed. Such book to be presented at each Meeting of the Council. Every Chairman of Section shall report at each Meeting of the Council. Every Chairman of Section shall report as to the work of his section at the Annual Meeting of the Society.

20.—Any Members of the Council other than Ex-officio Members who shall have failed to attend half the Meetings of the Council held in any one year, provided that such non-attendance be not caused by illness or absence abroad, shall not be eligible for re-election, except by desire of the Members present at the Annual Meeting.

The President

21.—The President need not necessarily be selected from Members of the Society, and shall be elected annually. He shall deliver an Address at as early a date in the Winter Session as can be arranged.

Vice-Presidents

22.—Any Member of the Society who, in the opinion of the Council, shall have rendered distinguished service to Science or to the Society, shall be eligible for election as a Vice-President at the Annual Meeting, as long as he or she remains a Member of the Society.

23.—Each of the Vice-Presidents in rotation shall be requested to act as Chairman at the General Meetings of the Society.

Secretaries

24.—The Secretaries shall perform all the usual secretarial work; shall keep minutes of all Council Meetings, and the Annual Meeting, and a synopsis of all General Meetings. They shall cause a programme of each General Meeting to be sent to every Member seven days at least before each such Meeting. They shall make all preparations for carrying out all General Meetings and General Excursions, at which they shall receive from each Member his or her share of the day's expenses, and therefrom defray all costs of the Meeting. Any surplus of such collection shall go to the General Fund, and any deficit be defrayed out of that fund. They shall keep an account of all out-of-pocket expenses incurred in arranging Meetings and otherwise. They shall give notice of their election to all new members, they shall furnish a copy of the Annual Report to all Members who have paid their subscription, to Honorary Members, and to any such Scientific Societies as the Council may from time to time appoint to receive them.

Treasurer

25.—The Honorary Treasurer shall have the custody of the General Funds of the Society. He shall prepare a Financial Statement at the end of each Financial Year to be presented to the Council at the Meeting next preceding the Annual Meeting. He shall receive and acknowledge all Subscriptions, and shall issue tickets of Membership to all persons who are duly elected and have paid their Subscriptions. He shall bring before the Council any accounts that are due for payment. After presentation of the Balance Sheet to the Council, he shall submit it to the Auditors and lastly to the Annual Meeting of the Society.

26.—At the Annual Meeting and at all General Meetings of the Society, not less than ten Members shall form a quorum.

Annual Meeting

27.—At the Annual Meeting, which shall be held in the month of October, the President, the Executive Officers (except the Chairman and Deputy Chairman of the Council), the Hon. Librarian, eight Members of Council and two Auditors for the ensuing year shall be elected (either Auditor having the power to audit the accounts in the unavoidable absence of the other). At this Meeting the Council's Report of the past year, together with those of the Chairmen of Sections, and the Hon. Treasurer's statement of accounts, duly signed by the Auditors, shall be submitted.

28.—Alteration in the Rules shall be sanctioned by a majority of not less than two-thirds of the Members present and voting at the Annual Meeting, or at a Special Meeting called for that purpose, and no alterations shall otherwise be made.

29.—Notice convening an Annual or Special Meeting, together with any proposed alterations in the Rules, shall be given to Members at least seven clear days before such Meeting be held. Notice of General Meetings, and Council Meetings (if possible) shall be given at least seven clear days beforehand.

30.—On a written requisition, signed by at least five Members of the Society, the Council shall call a Special Meeting to consider any question as to the affairs of the Society, such Meeting to be called within three weeks of the receipt of the requisition, and at least seven days' notice shall be given to the Members. At such Meeting no other business than that mentioned on the requisition, and on the notice convening such Meeting, shall be considered.

Report of General Summer Excursions, 1913.

Hod Hill and Shaftesbury. The first of the Summer General Excursions took place on Wednesday, May 14th. Motor vehicles were used for the first time, and were much appreciated. Leaving the Square soon after 9.30 a.m., the party had a delightful run in splendid weather along the Dorset roads through Blandford to Hod Hill. Dismounting at the foot of the famous hill, the party made their way to the summit by the eastern approach, and crossed the ancient hill town to its N.W. side, overlooking the River Stour. Mr. G. Brownen, the conductor of the party, then gave a brief description of the place. Hod Hill was one of a chain of border fortresses of the Brythonic races, who controlled the crossing of the Stour at this particular point against the Goedel, or Gael. It is nearly 500ft. above mean sea level, and about 300ft. above the valley below. On the steep escarpment facing the Stour only one rampart and its ditch was deemed necessary by either Briton or Roman, but on the Northern and Eastern sides, which were naturally more accessible, the entrenchments were doubled and made artificially steep. Attention was called to two oblong depressions as water tanks, and a number of smaller circular depressions, indicative of the pit dwellings of the more ancient races who held the hill. Attention was next directed to the almost square portion of the North-west as a modification by the Roman conquerors, thus forming an exploratory camp for the district and also a controlling fortress of the British town.

Prehistoric relics in bronze, silver, stone and pottery, with uninscribed British coins, have been found here, as well as the Roman Imperial coinage of the first century A.D., from Claudius to Nero and Drusus. Iron weapons and coins of the later periods of the third and fourth centuries have also been found in the more sheltered valleys below. A valuable collection of the finds is preserved in the British Museum.

The party then proceeded to Shaftesbury, and, on arrival, were conducted by the Rev. F. Ehlvers, Rector of Shaftesbury, to the fifteenth century Church of St. Peter. This church has been restored, and is occasionally used; it contains interesting relics of the age immediately preceding the Reformation. From there they proceeded to the Town Hall, where, in a cellar beneath it, attention was called to the ancient history of the town and some of its municipal treasures, and relics of the famous Abbey. A visit was then paid to the Castle Hill and the site of the Abbey Church. Assembling near the site of the high altar in the nave, they were told the story of its foundation in the ninth century by Alfred the Great as "The abbey of our Lady," and over its nuns Alfred placed as its first Abbess his daughter, Ethelgifu. About a century later the body of King Edmund,

murdered at Corfe Castle, was brought from Wareham and interred in the north aisle, and a little later, after Edmund's canonisation, the church became known as the Abbey Church of our Lady and St. Edmund the Martyr, and was the resort of pilgrims until the dissolution, 23rd March, 1539, when the Abbess, Elizabeth Zouche, surrendered the Abbey to Henry VIII. From the fragmentary remains above ground and the results of excavations, the Abbey Church consisted of a nave, with north and south aisles, transepts and a crypt; its walls were thick and substantially built, its arcading formed of light and elegant columns adorned with delicate carvings, whilst the floor was a tesselated pavement. On some of its tiles the armorials of the great baronial houses of Clare, Monteacute, Brian, Stourton and Cheney are still visible. After a short visit to the Castle, the members had tea and motored home, reaching Bournemouth between 7 and 8 p.m.

Athelhampton Puddletown and Bere Regis.

The second general excursion took place on Wednesday, May 28th, when 53 members motored to the beautiful old Manor House, Athelhampton Hall, by the kind permission of A. C. de Lafontaine, Esq., J.P. As the name indicates, it was originally the home of a Saxon noble whose personality has not been identified; but one of the early families holding the estate—the Pydells—are said to be descendants of the old Saxon kings of Wessex, whose armorial bearings (four kites heads erased) are to be seen in the stained glass of the hall window. The oldest portions of the Hall and its courtyards were probably built in the reign of Henry VII, and form a unique example of Early Tudor domestic architecture.

The Hall became the property of the family of Martin, by marriage, in the time of the Early Plantagenet kings, who held it until the end of the sixteenth century, during the reign of Queen Elizabeth.

The banquetting hall is surrounded with rich panelling, arms and armour, it has a huge Tudor fireplace, the large window is filled with stained glass of heraldic shields, and the roof is very fine. A ramble was made through the old-world gardens, where the rare old culverhouse, or dovecote, was much admired.

The party next visited Puddletown Church, by the courtesy of the Vicar. The church and vicarage belonged to the Twynham Monastery from the twelfth century, and possibly earlier. The font and a few fragments of Norman work remain, but the nave seems to indicate the beginning of the sixteenth century, and may have had some connection with the erection of Athelhampton Hall. The south transept, or Athelhampton Chantry, contains the tombs and brasses of the Martins and their alliances.

Amongst the notables who held the vicarage were Reginald Pole, afterwards Cardinal, in the reign of Henry VIII., and John Draper, the last Prior of Twynham, until A.D. 1552.

The party then motored to the Church of St. John Baptist, at Bere Regis, another ancient church exhibiting traces of all styles of architecture, from the Norman to the Tudor period. It consists of a chancel, nave, aisles, south porch and an embattled western tower, and was restored by Mr. Street about 30 years ago.

The magnificent roof, with its bold carvings, is said to have been the gift of Cardinal Morton to the place of his birth and boyhood. The church contains the tombs of the Tubervilles, now made famous by Mr. Hardy's novel, "Tess of the D'Urbervilles."

The party were grateful to Mr. Brownen for his lucid and interesting descriptions of all the places visited. After a welcome tea at the Drax Hall, the return journey was made at the close of a fine summer day.

A Cruise in Poole Harbour. On Thursday, June 12th, a delightful day was spent by 59 members in a cruise in the Lakeland of Dorset, under the able and genial guidance of Mr. Harry Pouncy, Assistant Secretary of the Dorset Field Club. The party were met at the Tramway Terminus by Mr. Pouncy, who conducted them to the Customs House steps, and on the way he discoursed, in his usual versatile manner, on the old bits of Poole along the route—the Georgian Town Hall, the almshouses of St. George's Guild, the old Merchant Houses, the Town Cellars, and the Customs House, with the panelled effigy of Benjamin Skutt. Motor-boats awaited their arrival at the steps, and soon they were on the way up the Wareham Channel, passing *en route* the Hamworthy Potteries and Doulton's Clay Works, to Russel Quay, Attewelle, where they debarked. A halt was made for a few minutes, when Mr. Pouncy gave a brief sketch of the Harbour—referring to its geography, geology, natural history, and reminiscences of its interesting past history. A short walk across the heath brought them to the pretty hamlet of Arne. Here they climbed the beacon, surmounted with its ancient tumulus and thickly clad in bracken.

A splendid view of the harbour, with its five islands, was obtained, and here a halt was made for lunch.

The famous heronry, or "cranery" as it is locally called, lies about a mile to the west in the plantations.

The party then retraced their steps back to the village and inspected the simple Early English Church, with its three-light east window, from which there is a charming view of the inland waters, its rough adze-hewn roof timbers and its pre-Reformation altar-slab of a shelly limestone with the five consecration crosses.

A pleasant walk across the fields led to Shipstal, where the party re-embarked and went up the Wyche Channel, and then by Ram's Horn Lake entered the upper " tail " of Sou' Deep Channel, and on to Ower Quay, where they again landed.

It was from Cleavel Point, a short distance eastward, that, until the reign of Queen Anne, when the traffic was diverted to Swanage Bay, most of the Purbeck Marble and Stone, after being hauled from the Quarries through Corfe and along the rough tracks over the heath, was for centuries shipped off in lighters for use in so many of the cathedral and conventual churches of the land. The quaint custom is still observed every Ash Wednesday by the Ancient Company of Purbeck Marblers and Stone Cutters of kicking a football and carrying a pound of peppercorns from Corfe to Ower Quay and presenting both to the tenant of Ower Farm, who receives them on behalf of the Lord of the Manor of Rempston, as tribute for the keeping open of the wayleave across the heath on the chances of its ever being used again. From Ower Quay a walk was then taken for about a mile and a half across the heath to the famous Gull Decoy Pond, which the party were enabled to view by the courtesy of Captain Marston, R.N., the lord of the manor. For many years the black-headed gull has been strictly preserved from all depredations in a large pond fringed with flowering rushes and studded with wooded and reedy islets, making an ideal resort for this gregarious bird. It is computed that about 2,000 pairs have nested here this season, some rearing two broods. Steps were re-traced to Ower Quay, and a short ride brought the party to the house-boat—the Mayflower—where a welcome tea awaited them.

At the invitation of Mr. C. Hall, the proprietor of Green Island—the old St. Elyn's, which, with Ower, belonged to the Abbey of Milton—most of the party landed there and inspected his rock-garden, and also specimens of the ancient bones, pottery, quern stones, worked flints, and other relics dug up in various parts of the island, generally at a depth of about three feet under the black, peaty soil.

The boats then steered their way homeward down " Sou' Deep," passing Newton's Bay, round Brownsea Island, into the Main Channel, and on to Poole Quay, thus ending a most enjoyable day.

Sherborne. An excursion was made to Sherborne on Wednesday, June 25th, by 53 members. Leaving Bournemouth by the 9.40 train for Sturminster Newton, from whence they went in brakes by road to Sherborne, where they were met by Colonel Sir William Watts, K.C.B., a member of our Society, and one of the Governors of the School, who had kindly made all the arrangements for seeing the principal buildings. The party proceeded first to the School, where Mr. W. B. Wildman, the historian of Sherborne, gave an address.

He said that Sherborne owes its existence to the fact that it was chosen in 765 to be the site of the Cathedral Church of St. Ealdhelm, the first Bishop of Western or Newer Wessex. Like Wells and Salisbury, it is a Bishop's town, but differs from them in this, that from 998 to 1539 it was also a seat of a Benedictine Monastery. It suffered two shocks, the first when it lost its Bishop in 1075, the second when its Abbey was dissolved in 1539. Sherborne was never a walled town; it lay under the protection of the fortified palace of its Bishop and its position, remote from the sea and the waterways rendered it safe from the Danish inroads. This and the fact of its being the second city of Wessex accounts for its being selected by King Æthalbald for his capital when Winchester in 860 was laid waste by the Danes and it continued to be the capital of Wessex till about 878.

It is very probable that King Alfred spent his boyhood and received here what education he had, during the reign of his brother, King Æthelbert.

Alfred's two brothers, Æthelbald and Æthelbert, who successively reigned before Æthelred and himself, were buried in the Abbey Church, as also were Bishop Ealdhlem, St. Osmund, Bishop of Salisbury, and Stephen Harding, author of the "Carta Caritatis" and the real founder of the Cistercian Order.

Roger Niger, of Caen, Abbot of Sherborne and Bishop of Salisbury, built the Norman Castle and the Norman part of the Abbey Church. It was he who organised the English Court of Exchequer for Henry I., and it was in consequence of his rebellion against King Stephen that the Bishops of Sarum were deprived of Sherborne Castle for over two centuries.

With the exception of a small part of the west front of the Abbey Church, there is not, as far as is known, a single piece of wall now standing in Sherborne which was standing in the year 1107 when Roger became Bishop of Salisbury and Abbot of Sherborne. The doorway, now blocked up, on the north side of the west front of the Church, is Saxon work, probably Ealdhelm's, and is all that is left. The Norman Church, which Roger built, extended as far east as the present Church does, excluding the Lady Chapel, and rather farther west than at present, for before the Parish Church of All Saints' was built on to the west side of the Monastic Church towards the end of the 14th century, the west front of the Church was embellished with a large porch of Norman work.

In the 13th century a Lady Chapel of three bays was added, only one of which remains, now included in the Old Master's House. In the 14th century important changes were made on the outside. The Norman west porch was pulled down, so that the new Parish Church of All Saints' might stand directly against the west front of the Abbey Church. Where All Hallows was standing, with its pinnacled western tower, one would see a church some 350ft. long, with a central and western tower, so that it would look

like Wimborne Minster on a larger scale. In the 15th century great changes were made. The choir was taken down and rebuilt from the ground by Abbot Bradford (1436—1459), the nave was restored, though much of the Norman wall was kept by Abbot Rampsham, or Ramson (1475—1504). To these two we owe the present splendid fabric.

Of all the institutions in Sherborne that one which has kept its dwelling place longest, which is to-day what it was before Wessex became one with England, is Sherborne School. The old Castle is a ruin, the Almshouse dates only from the 15th century, the Abbey Church became the Parish Church only in 1540; but the School began with the Cathedral in 705, it educated Stephen Harding in the 11th century, it lived through the storm of the dissolution of the Monastery in 1539 to get a charter and a new endowment from Edward VI. in 1550, and it still continues to flourish.

Mr. Wildman took the party into the Great Hall, after which Sir William Watts showed several other of the buildings, including King Edward VI. dining hall, the library and museum. The library possesses the original accounts of the School Estates from 1553 to the present day and the Minute Book of the Governors from 1592 to the present day. There is a splendid collection of the great books of the 17th century, all in good condition, but the most precious are six volumes of music, published 1587—1593. No other library has these volumes. They are: (a) "Ballets," by Gastoldi, for five or six voices, the only complete copy known to exist. The British Museum has an old Canto part, and at Bergamo there is an alto part. (b) "Paradiso Musicale," a collection of Italian Madrigals, for five voices, published at Antwerp in 1596. There is also a copy of an Old and New Testament in a Red Indian dialect, which no one now understands, and a copy of Bedel's Irish Old Testament, published in 1685. The oldest extant catalogue of the library is in MS. on parchment, dating from 1694. Down to the year 1725 all books in the library were chained to the shelves, except six, five of which are dictionaries, and the sixth "A noble collection of Maps, gift of ye learned Th. Windham, Esq." The marks of the chain rivets can still be seen, with the holes through the boards.

In the museum is a remarkable fossil of the head of a Megalosaurus, said to be the only one in existence which has a nose. There is also a magnificent collection of Dorset fossils.

The Abbey Church was next visited, under the guidance of the Verger. Time did not admit of a visit to the Almshouse, or to the ruins of the Castle.

The party then adjourned to an excellent tea at Ford's Restaurant, and afterwards left in brakes for Sturminster Newton in time for the 6.34 p.m. train for Bournemouth.

Bingham's Melcombe and Milton Abbey.

A visit was paid on Saturday, July 5th, by 70 members to the beautiful old Manor House of Bingham's Melcombe, where they were received by Mrs. Bosworth Smith, the owner. The journey was made in motor chars-a-banc, the route being through Bere Regis and Puddletown. The house was built in the reign of Edward I.—the style of the plinth of a small piece of one of the walls points to the time of King Stephen.

In a window in the Hall, which was originally the Chapel, are the Arms of England and Spain quartered together, which shows they were placed there in the time of Philip and Mary. There is a large table in the hall, some centuries old, with a flap to it which gave rise to the expression "above board," because the head of the house sat at it and the family, servants, and retainers sat below it. Above the hall is the drawing room with a small "powdering room" adjacent. In the "gun room" is a large oval table made of chestnut wood, curiously inlaid, mounted on a sea chest instead of legs, taken from one of the ships of the Spanish Armada. In a room over the old Gatehouse are two beams —date 1300. In the garden is an immense yew hedge over 20ft. thick and proportionately high, the intricate boughs and stems of which render it practically impenetrable even to a bullet. It dates from the time of Henry VIII.

A visit was then paid to Hilton Church to see twelve curious mediæval painted panels of saints taken from Milton Abbey. On the north wall of the church are some good 15th century gargoyles.

The party then proceeded to Milton Abbey, where they were met by the Vicar, the Rev. Herbert Pentin, who conducted them to St. Catherine's Chapel, on the hill slope, overlooking the stately Abbey Church. Here a halt was made for lunch, after which Mr. Pentin gave a short description of the building. It was founded by King Athelstan as a thank-offering for his victory at the battle of Brunanbush. He had previously encamped near the site and had dreamt he would conquer his enemies in the coming battle and become King of England. "Christ helping him, he had the victory, and there slew five kings and seven earls" (Saxon Chronicle). Little remains of the original edifice, it underwent considerable restoration in Norman days and again in the sixteenth century. The arches of the doors are Norman and the windows early Norman and Perpendicular. At present it consists of a Nave and Chancel and is dedicated to St. Catherine, the patron Saint of spinsters, and in the north wall in a stone with three small holes, into which it has long been the custom of the village maidens to put their fingers and pray for a husband, using the following doggerel rhyme:—

St. Catherine, St. Catherine, O lend me thine aid
And grant that I never may die an old maid.
A husband, St. Catherine,
A *good* one, St. Catherine;

But arn-a-one better than
Narn-a-one, St. Catherine.
Sweet St. Catherine,
A husband, St. Catherine;
Handsome, St. Catherine;
Rich, St. Catherine;
Soon, St. Catherine.

Descending the hill the Abbey Church, founded by King Athelstan, was then visited. The original edifice was built by Athelstan, which was destroyed by fire in 1309 and the present edifice was commenced in 1322 and added to from time to time, the additions being built of stone from Tisbury and Ham Hill, till the Dissolution in 1539 and shows many different styles of the architecture, the choir and presbytery of seven bays with aisles are of the First Decorated Period, the south transept of the Second, and the two western piers of the " crossing " of the Third Decorated Period. The north transept and central tower are of the Perpendicular style. Among the objects of interest in the church are two ancient paintings, representing King Athelstan and his mother; a Tabernacle once used for reserving the Eucharist; and the beautiful white marble effigies of Lord and Lady Milton. The font is a remarkable one of a type used in Denmark, consisting of two female figures representing Faith and Victory with a baptismal shell at their feet.

After leaving the Church Mr. Pentin pointed out the site of the handsome fifteenth century market cross with its ascent of no fewer than thirty steps, around which the old village clustered; only a massive octagonal socketstone, said to be a portion of the original cross, now remains. A tree planted by the late King Edward was also shown.

The party then walked back through the Park to the Hambro Arms Hotel for tea. Thanks were heartily accorded Mr. Pentin for his kindness in acting as guide and for his graphic and interesting address and the return journey was then made, reaching Bournemouth about 6.30 p.m.

Wilton. On Wednesday, July 16th, a party of 50 members made an excursion to Wilton in motor vehicles, leaving Bournemouth about 9.30 and arriving shortly before noon.

A visit was first made to the beautiful Church of SS. Mary and Nicholas, erected in 1844 by the Right Hon. Sidney Herbert, the first Lord Herbert of Lea. It is built in the style of the Roman Basilicas, and has a Campanile detached but connected to the church by a cloister. The pillars on either side of the nave are lofty with elaborately carved capitals, each of a different design. There is 13th century glass in the windows of the apse,

and in the pulpit the small marble pillars contain 13th century mosaics from the Church of Santa Maria Maggiore in Rome.

After lunch they proceeded to Wilton House, the seat of the Earl of Pembroke, who kindly gave permission to inspect the house and grounds. They were conducted through the principal rooms, which are filled with pictures by Old Masters, statues, busts, and other treasures. In the entrance hall are several suits of armour, chiefly taken at the battle of St. Quinton in 1557. The lofty ceilings are painted in the Italian style. Many of the statues and busts are copies of well known examples in the Italian Art Galleries, among them being the " Apollo Belvedere " in the Vatican and the " Medici Venus " in the Uffizi Gallery in Florence. There are several Roman Sarcophagi from the Columbarium, discovered on the Via Appia in 1726 and one found near Athens.

The party then enjoyed a walk in the gardens and grounds. These are tastefully laid out, and contain a number of very interesting trees and shrubs. Majestic limes, planes, and ash trees forming a background with the waters of the Nadder glistening in the foreground. There were several good specimens of the Himalayan pine, *Pinus excelsus*, a fine tulip tree, a Medlar raised from Geo. Herbert's tree at Bemerton, a fine Alder 50ft. high and a pendulous form of the Nootka Sound Cypress. On the lawn in front of the house is a fine group of Lebanon Cedars.

In a small temple in the garden,—according to credible tradition—Shakespeare played in " As you like it."

On the other side of the Nadder is a deer park; it was the scene of a victory by King Alfred over the Danes about 870, and a tumulus marks the burial place of the slain.

Wilton was an Abbey for about 700 years, till the dissolution in 1539, and in 1542 the site and surrounding lands were granted to William Herbert.

After leaving the gardens some of the party visited the Guildhall, where, by the kind permission of the Mayor, Mr. Alderman Slow, several interesting documents were inspected, among them being a Charter of Henry I., one of King John, one signed by Queen Victoria, and a document bearing the signature of Judge Jeffreys.

After tea at the Pembroke Arms, the return journey was made. On the way a visit was paid to Old Bemerton Church, specially interesting from its connection with George Herbert, who was Rector from 1630 to 1632. He died at the Rectory, and lies buried within the altar rail of the Church. The present Rector, the Rev. Canon Warre, courteously invited and personally conducted the party through his parsonage and garden, where was seen the old Medlar tree planted by George Herbert nearly 300 years ago.

The homeward journey was then resumed and, after an agreeable drive home through Sopley and Ringwood, Bournemouth was reached about 8 p.m.

Old Sarum. On Wednesday, August 20th, 40 members paid a visit to Old Sarum. They left Bournemouth by the 10.25 a.m. train, and, on arrival at Salisbury, drove to Old Sarum, where they were met by Colonel Hawley, F.S.A., who is in charge of the excavations. Commencing on the east side of the Castle, they were first shown the Chapel with remains of the altar, the vestry, hall and treasury, the last-named appeared to have been of special strength, three steps remaining of a spiral staircase, show that it must have had an upper storey. Near by were four masonry rubbish pits, two being of a depth of about 40ft. Adjoining these was a strong square tower on the Castle rampart, the foundations of which had been strengthened with cement and concrete. Close to this, on the north side, were double gates, the hole in the wall to receive the bar being still to be seen. The entrance had been blocked up and a postern made for strategic purposes for greater security. Another very deep pit adjoining the gates showed that it had been built with very solid masonry.

Leaving the Castle, the party passed round the east front of the Castle ditch to the north-west quarter of the city, where formerly stood the Norman Cathedral. The excavations of the Cathedral have only recently been carried out. Its full outline is not yet excavated, but it appears to consist of a west front with towers raised upon foundations of great depth and strength, embedded in the solid rock of the hill, a nave 150ft. long by 80ft. wide extending eastwards with transepts, that on the south having a porch, and that on the north a vaulted chamber or crypt.

The excavations on the south side of the Cathedral show that it was used as a cemetery, and there had been a postern passage to the Castle ditch from the south angle of the precinct wall of the garth. The west gate of the city was discovered about 150ft. south-west of the west front of the Cathedral, while along the curtain wall of the city northwards for nearly 200 yards indications of buildings, pits and towers have yet to be examined.

Colonel Hawley then conducted the party to the temporary museum erected within the city ramparts, where the fragmentary relics of carved stone, implements of war and domestic vessels were stored.

In accordance with a decree of the Council of London (1078) Bishop Herman, of Sherborne, removed his seat to Old Sarum and commenced to build a new Cathedral, and his successor, Bishop Osmond, a relative of William the Conqueror, more energetically prosecuted the task, as he united in his own person the offices of Castellan of the Castle and Bishop of the See. The Cathedral was completed and consecrated in 1092, and only a few days later it was severely damaged by a thunderstorm. The Bishop set about the repair of the damage, and his successor, Bishop Roger, either rebuilt or repaired it in a most costly manner.

But after this period of courtier prelates evil days came to the See; the civil and ecclesiastical authorities could not agree. Peter of Blois writes of the Cathedral of Old Sarum as "The Ark of God shut up in the temple of Baal." So in the episcopate of Bishop Herbert Poore, the sixth Bishop of Old Sarum, the See was removed to New Sarum, and the decay of Old Sarum began.

After inspecting the interesting exhibits in the museum, the party left for Salisbury, and were driven to the Church of St. Thomas of Canterbury, built in 1240 by Bishop Bingham, altered and partly rebuilt early in the 15th century, and restored by Mr. Street about 50 years ago. It is chiefly noted for the remarkable fresco of the Last Judgment over the chancel arch in excellent preservation.

From the Church the party walked to the Poultry Cross, erected by a recanting Lollard as his penance in the 14th century.

Tea was then had at Sutton's, and the members returned home by the 4.54 p.m. train.

Canford Manor. The last of the General Excursions was made on Tuesday, September 16th, when nearly 80 members paid a visit to Canford Manor, the seat of Lord and Lady Wimborne. They went by the 11.45 a.m. train for Wimborne, and from thence they drove to Canford Church, where they were met by the Vicar, the Rev. G. J. J. O'Shea, who gave a description of the Church.

The date of the dedication of the Church was unknown. The living was what was known as a "royal peculiar" and attached to the Manor, the Church not being under the jurisdiction of the Bishop of the Diocese; which is no longer the case. Some of the massive columns and arcading are of Norman origin; the lower is peculiar in its position, it is built in three tiers, the lowest of which is 10th century work, and the others of the 12th century. After the Vicar's address, Mr. Geo. Brownen read a short paper on Canford and its possessors. In the late Saxon period the estate was held by a Crown tenant named Oliver, who was dispossessed by the Norman Conquest of 1066, and in the Domesday of 1086 it was held by Edward of Old Sarum, the Shire Reeve of Wilts, whose immediate descendants were created Earls of Salisbury. The Domesday record states that Canford Manor consisted of about 3,000 acres, of which about 1,380 acres were directly associated with the ancient hall. In the reign of Henry II. the daughter and sole heiress of Patrick of Salisbury was the wife of William Longespée, natural son of Henry II. and fair Rosamund. This warrior was made the founder of a new line of Earls of Salisbury; he was poisoned at Old Sarum, and his tomb is in Salisbury Cathedral. His son died in the Crusades, and his grand-daughter, in her widowhood, was forcibly abducted from her home at Canford in the troubles of Henry III. The

estate passed by marriage to the Lincoln and Lancaster Earldoms for short periods, but early in the reign of Edward III. it was in the hands of the Crown. It was then given, with the title of Earl of Salisbury and many honours, to William de Monteacute for special and dangerous service at Nottingham. From 1337 till 1428, with a short interval of a few months in 1400, the Canford Estate remained in the hands of the Monteacutes, and, therefore, it could not have been held (as tradition asserts) by John of Gaunt, who lived 1340—1399. Mr. Brownen was disposed to assign the so-called " John O'Gaunt's " kitchen at Canford with its large fireplaces and significant 14th century architecture to William de Monteacute, the second Earl (1344—1397), who died in Christchurch Castle and was buried in Bisham Abbey, Berks. It was suggested that the two noblemen were not only of about the same age but were politically and dogmatically Lollard or Wickliffite in sympathy, so that possibly John O'Gaunt was a visitor to Canford. The turbulence of the Wars of the Roses destroyed the family of Salisbury and their right of inheritance—passing first to the Crown by successive attainders, and then to private hands; it was obtained by purchase by the ancestor of the present owner, Lord Wimborne.

After leaving the Church the party went into the Park, where lunch was taken. The chief object of interest in it is a very remarkable Spanish chestnut tree, 1,100 years old. Suckers had grown up round the parent stem and formed one enormous gnarled trunk. Some idea of its huge growth may be formed from the fact that it took 12 members, with joined hands and extended arms to encircle it.

The Nineveh Court was then visited. This is a portion of a wing of the mansion, built expressly to house a part of the celebrated relics of ancient Nineveh, discovered by Sir Henry Layard and placed in this court in 1851. The relics consist of a great winged bull and lion, and several bas reliefs, which were examined with great interest.

The party then proceeded to the ancient kitchen, with its great fireplace and its arch, unquoined or keyless, but large enough to roast an ox. The members were then permitted, by special permission, to inspect the fine suite of rooms in the house. It was a gracious concession to the Society on the part of Lady Wimborne, as it had not been open to visitors for many years. In the noble hall, with its lofty roof, the upper part was hung with fine Gobelin tapestries, while the lower portion was panelled with carved oak. The grand staircase also contained richly carved work. The magnificent suite of rooms was hung with fine pictures by old Masters, and among other treasures was a collection of rare Oriental china.

The party then returned to Wimborne and partook of a good tea at the Griffin Hotel, and left by the 5.3 p.m. train for Bournemouth.

Proceedings of Sections.

Archæological and Historical Section.

CHAIRMAN: G. BROWNEN, F.C.S.
SECRETARY: H. LE JEUNE.

FIVE papers were read at five Sectional meetings during the first half of the year and were well received, and their authors thanked for their services. The papers were as follows:—

Nov. 21, 1912. A Review of Archæological and Historical Progress during the past year by the Chairman. This paper was published by request of the Section in the last volume of the Society's Proceedings.

Dec. 19, 1912. A Lecture by the Rev. F. A. Allen, M.A., on "The Old Norse Colonies in Greenland: a Story of Isolation and Race Degeneration."

Jan. 23, 1913. A Lecture on "Isabella de Fortibus, Countess of Albemarle, a romantic life of the 13th century English Baronage," by the Chairman.

Feb. 6, 1913. A Lecture on "The Preservation of our Mediæval Antiquities," by Mr. H. Druitt.

Mar. 29, 1913. A Lecture by Mr. W. Ravenscroft, F.R.I.B.A., F.S.A., on "Early Days of Christianity in Rome in the light of Recent Exploration." This lecture, promised to the Section, was appropriated to fill a gap in our General Lectures (q.v.).

April 24, 1913. A Lecture on "The Book of the Dead: or the Egyptian Oldest Ritual Service," by the Chairman.

The indoor or lecture session of the season then terminated.

The strictly sectional excursions were as follows:—

May 17, 1913. An Excursion to West Parley Church and Dudsbury Camp (prehistoric), conducted by the Chairman.

June 4, 1913. An Excursion to the Lake Village at Meare, near Glastonbury, and Glastonbury Abbey, conducted by the Chairman and Mr. Le Jeune.

July 23, 1913. An Excursion to the Romano-British Village of Woodcuts and Tollard Royal, conducted by the Chairman and Mr. Le Jeune.

Aug. 9, 1913. A combined Excursion with the Photographic Section to Swanage Church and Godlingston Manor, conducted by Messrs. Dodshon, Homer and Brumell.

Sept. 8, 1913. An Excursion to Rockborne Church and the excavations of Mr. H. Sumner on Rockborne Down, with short halt at Whitsbury Castle Ditches, conducted by the Chairman and Mr. Le Jeune.

Many of the General Excursions of the session had great antiquarian interest. Of these we may name Hod Hill and Shaftesbury, Athelhampton, Puddletown and Bere Regis, Sherborne, Milton Abbas and Bingham's Melcombe, Wilton, Old Sarum and Canford Manor (described elsewhere). With these meetings and excursions the year's meetings closed.

Botanical Section.

CHAIRMAN: MISS C. AGNES ROOPER.
SECRETARY: R. V. SHERRING, F.L.S.

CHAIRMAN'S REPORT.

The Report of the Botanical Section is very good. Progressive work has been carried on with regard to the Herbarium, the satisfactory result achieved is principally owing to the constant interest and labour of Messrs. Sherring, F.L.S. (the hon. secretary), Swain and Shillitoe. During the Session, from November, 1912, till April, 1913, inclusive, weekly meetings were held in the Society's Room in the Municipal College, when the Herbarium was arranged and classified.

The following Papers were also read during the Session:—

Nov. 14, 1912. On "Plant Formation and Plant Association," by Miss C. Agnes Rooper.

Dec. 5, 1912. On "The Career of a Tree Fern from its Birth to its Death," by Mr. Charles J. Parmiter.

Dec. 21, 1912. A General Lecture on "The Evolution of Plant Forms," by the Rev. Professor George Henslow, M.A., F.L.S., F.G.S.

Jan. 16, 1913. On "The Heathlands of Hampshire," illustrated with lantern slides, by Mr. W. Munn Rankin, M.Sc., B.Sc.

Feb. 20, 1913. A Meeting was held in Trinity Hall, at which the Rev. Professor George Henslow gave a Lecture on "The Influences of Heat and Light in Assimilation, Transpiration and Respiration," illustrated with lantern slides.

March 13, 1913. "The Native Plants of Britain and Germany, a Comparison," by Miss C. Agnes Rooper.

April 13, 1913. "Flowers in Stone as applied to Church Architecture," by Miss Ida Roper, F.L.S. This was a General Lecture, but was of special interest to the Botanical Section.

Secretary's Report.

Field Work.

Excursions were arranged as follows:—

April	1st.	Brockenhurst Park and Rowden Farm.
May	7th.	Kimmeridge (abandoned).
,,	21st.	Wool, Cullpepper's Dish, and Bryant's and Turner's Puddle, returning by Chamberlayn's.
,,	31st.	Hinton Admiral.
June	18th.	Corfe Castle, Scotland and South Middlebere.
July	18th.	Brockenhurst, Hatchet Pond and East Boldre, returning by Buckler's Hard and Beaulieu.
Aug.	31st.	Corfe Castle, Thrasher's Heath, Bushey, Forrest Lane and the Downs.
Sept.	23rd.	Fungus Foray at Holmsley.

Working parties covered the following districts:—

Hengistbury Head.
Wareham and Stoborough (westward).
Christchurch Meadows.
Wareham and Stoborough (eastward), returning by Red Cliff.

Exceptionally fine weather and carefully detailed arrangements made a most successful Field Session, the ground covered being mostly new to members. Many of the rare plants of the district were found.

April 1st. Brockenhurst. In the absence, through illness, of the Chairman and Hon. Secretary of the Section, Dr. Shillitoe ably conducted the party through the old-world gardens, by kind permission of Lady Morant, returning by way of Rowden Farm.

May 21st. Mr. R. V. Sherring conducted the party, going from Wool by brakes to Cullpepper's Dish, where lunch was partaken of in this vast depression. Afterwards collecting was begun along the route to Bryant's Puddle, and driving thence as far as Turner's Puddle, the members visited the church and walked by the banks of the river to Chamberlayn's. Very fine arborescent clumps of the great panicled sedge (*Carex paniculata*) were seen and admired. The brakes were joined at Chamberlayn's, and a return made to Wool for tea.

May 31st. Hinton Admiral. Conductor, Sir Daniel Morris, by request. The Alpine and Rock Gardens covering a considerable area and artistically arranged proved most interesting. Possibly the largest specimen of *Fatsia japonica* (20 feet high and 25 feet through) in the South of England was met with. Also beautiful groups of *Osmunda*, flanked by groups of Japanese Irises. *Primula Bulleyana* was in fine order. A pergola with marble pillars, lately imported from Florence, attracted attention. The ornamental trees and shrubs surrounding the extensive and well-kept lawns proved singularly instructive by their growth and habit. A tree with the appearance of an Atlantic Cedar was regarded as a possible rare form of Deodara The Monterey pines (*P. insignis*), of great age, formed a fine avenue to the charming little Parish Church with its well-kept churchyard.

June 18th. Corfe Castle. Mr. R. V. Sherring had spent three days in arranging for this excursion and in making a list of the plants. Before starting a fine exhibition of most of the orchids of the district, and other flowers and sedges were shown and explained. The route taken was by Norden Pond, through the woods to Scotland and South Middlebere Heath, returning by a different way to Corfe for tea. The detailed work over the rich and varied ground was much appreciated as shown by the deep interest taken by the members.

July 18th. Members were met at Brockenhurst by brakes and driven to Hatchet Pond. The flora here was explored, and the journey continued to East Boldre, where lunch was partaken of. Afterwards, by kind permission of Lord Montagu, Ashen and other woods were visited until the main road was reached. The lovely views of the upper reaches of the Beaulieu River were much admired en route to Buckler's Hard. Members were shewn the "meadows" of *Spartina*, exhibiting the golden hue, especially mentioned by Dr. Stapf. After a short stay here the brakes were entered and a return was made via Beaulieu to Brockenhurst for tea. Conductors: Mr. R. V. Sherring, F.L.S., and Mr. Munn Rankin, M.Sc.

August 31st. From Corfe Castle Mr. R. V. Sherring conducted the party, by the kind permission of Captain Marston, to Thrasher's Heath to see the various Heaths and other plants there in bloom, thence, by Flashelt Plantation, Brenscombe Heath and Forrest Lane, on to the Downs. Here Mr. Sherring referred to a previous report, and pointed out in detail the spreading of the *Spartina* grass in the various creeks, beginning at Arne on to Middlebere Creek, Round and Long Islands, and up the west and east branches of Wych Creek, thence round Fitzworth Point to Ower and Newton Bays to Green and Fursey Islands, past Goathorn, on to Brand's Bay, Bramble Bay and the South Haven. He commented on the great increase of the grass in those places, and Mr. Rankin followed with remarks on the successive advances it had made from Southampton Water, by Lymington and Beaulieu Rivers to Poole Harbour. To illustrate this he also referred to Dr. Stapf's paper in volume V. The weather was clear, and the views from the Downs were greatly admired on the way back to Corfe for tea.

Sept. 23rd. Fungus Foray at Holmsley. This was conducted by Mr. J. F. Rayner, F.R.H.S. The Holmsley enclosure was explored, and afterwards Brown Hill and Wootton Copse. Lunch was taken in the Wood, and search was made along the ridings, where many interesting specimens were collected. *Boletus parasiticus* was a first record for the forest. Also the more common *B. pachypus* and *B. satanas*. Only one specimen of the fly agaric (*Amanita muscaria*) was met with. Another new record was *Otidea leporina*, so named from its resemblance to a hare's ear. On the whole, the number of specimens collected was quite appreciable, and a very interesting and instructive afternoon was spent. The weather conditions were singularly favourable. Mr. Rayner received the warm thanks of the party for his valuable assistance.

The Chairman of the Section, Miss Agnes Rooper, conducted the working parties to Hengistbury Head, Stoborough and Christchurch Meadows, and Dr. Shillitoe to Stoborough and Red Cliff.

The attendance at the excursions has increased, and fresh members have been added. On some of the general excursions new districts were worked with advantage. Notwithstanding the illness of the Chairman and the Hon. Secretary, the work of the Section has been well maintained, and many plants added to the Herbarium. It is gratifying that these included rare plants found in new localities.

Through the kindness of the Rev. E. F. Linton, a valuable gift has been made to the Society of a large part of the Botanical collection of the late Rev. W. H. Purchas, and others have kindly sent specimens. Thanks are due to them and to Lord Montagu, Sir George Meyrick and Captain Marston for leave to visit their properties. The Section has lost a staunch friend in Mr. Galpin, who took a keen interest in its work, and will be much missed.

NOTE ON *SPARTINA* GRASS.

The work of watching the growth of the *Spartina Townsendii* has been continued by Mr. R. V. Sherring and photographs taken. On the occasion of the Society's General Excursion to Arne Beacon, good views were obtained, and the rapid advance of the grass surrounding Round and Long Island district was observed by field glasses and the alterations described. In Arne Bay, between Patchin's and Shipstal Points, meadows of the "grass" were pointed out. Looking northwards, the band from near Rock Ley Bridge was seen to be thicker, and the two island patches to the westward of this, at the entrance of the Wareham Channel, had much increased, whilst long meadows of the grass were passed parallel with the course taken to Ower Bay. This inlet and Wych Creek vie with each other as the headquarters of the growth. It is of interest to recall that the Rev. E. F. Linton first mentions *Spartina* in his "Flora of Bournemouth," page 246:

> "Estuaries, on mud below high water mark; very rare P., July and August.
>
> 4. Poole estuary, near Ower, discovered by J. C. Mansel-Pleydell, Esq., 1899."

No mention is made in the "Flora of Dorset," 2nd edition, 1895, of any *Spartina*, but it was, possibly, known to a gamekeeper and others before that time, but not under name.

Again two days were spent examining the east and west creeks of Wych inlet. In the westerly inlet, little, if any, advance has been made, whilst the eastern side of Wych to Fitzworth shore is become a vast meadow. Wareham River seems to be free from it, but at the bottom of the L. & S.W. Railway banks, south of the line, there is an increase. The clumps are forming into line, and in places making a breakwater against the wash of the tide. At Poole, likewise, a noticeable increase is visible off the Fever Hospital.

The Plant Association that appears to follow the establishment of the *Spartina* grass-meadows in Wych Creek has been carefully noted, and under their shelter were seen:

Aster Tripolium, Linn (Starwort),

Statice Limonium, Linn (Great Sea Lavender),

Scirpus Tabernaemontani, Gmel (Glaucous Bulrush),

,, *maritimus*, Linn (Sea Club-rush),

Phragmites communis, Trin (Common Reed),

thus agreeing with the plants usually growing in other similar places on mud flats washed by the tides.

Captain Steel has also furnished us with some interesting notes, in which he states:

"The grass has much increased this year, and seems to have settled the mud banks, as I have been able to take a launch up the creek by Churchills, where I could not go before."

Fitsworth Point was another place visited in the neighbourhood of Corfe Castle. Standing as this does at an elevation of 50 feet or more above high water, it commands the finest near view of the grass in the Harbour. From here the south side of Round and Long Island, and the head of the South Deep Channel are visible, and on each side bands of *Spartina* are forming into an immense mass, which will shortly become a "meadow." These bands seem to run in an east and west direction on account of some special set of the tides laying down suitable mud banks.

Geographical Section.

CHAIRMAN AND SECRETARY: GEORGE DE CASTRO, M.R.C.S., Eng., &c.

During the winter session four lectures were delivered in this section, all having been offered to the Council by members of our own Society, and they were well illustrated, either by lantern slides, diagrammatic drawings, or interesting specimens of various kinds.

1.—On November 16th, by Mr. C. J. Parmiter, entitled "Our Present Knowledge of the Earth's Crust," upon which discussion was invited, and many remarks were made informally.

2.—On December 12th, by the Rev. W. H. Windle Cooper, M.A., entitled "The Dalmatian Coast Line, Montenegro and Corfu."

3.—On January 9th, by Miss Florence M. Gardiner, entitled "The English Lakeland, and its Literary Associations."

4.—On March 8th, by Mr. Augustus Barraclough, F.R.G.S., entitled "The Natural Regions of the World in General, and of Europe in particular," following which, in response to an invitation from the lecturer, an interesting discussion took place.

In addition to these a lecture on "Australia" was offered to the Section by the Rev. Dr. T. S. Carlyon, but it was considered by the Council as being of so wide an interest, that it was selected for delivery as one of the "General Lectures" in the month of February.

No suggestions were received during the earlier part of the summer session for any sectional excursions, but one was arranged for the month of August to Hengistbury Head by the

Chairman of the Section, who there read a paper on "The Bournemouth District," and the geographical aspect of the neighbourhood. This was greatly emphasized by Alderman James Druitt, who added information concerning both the Headland and the Harbour, and produced several old maps, charts, and plans to show changes which had taken place in years gone by, many of which had occurred during his own lifetime.

Mr. Brownen also drew attention to the great interest of the geographical position from an antiquarian's point of view, and these addenda to the programme were much appreciated.

The attendance of members has distinctly increased pro rata beyond even the numerical increase of the Society, and I trust that this may continue, as it shows a growing interest and vitality in the work of the Section.

Geological Section.

CHAIRMAN: DR. W. T. ORD, F.G.S.
SECRETARY: MR. H. ST. BARBE.

The Isle of Purbeck. The first meeting of the Session was held at the Society's rooms on Saturday, November 23rd, 1912, when Dr. W. T. Ord lectured on "The Geological Structure and Building of the Isle of Purbeck," with special reference to the great fault which traverses the Chalk and other Cretaceous strata, and its effect on the present position of the overlying Tertiary series. Some beautiful lantern slides of coast scenery, kindly lent by Mr. Pouncey, were much admired.

The Oligocene Formation. On Saturday, January 18th, 1913, a lecture was given by Mr. H. St. Barbe on the Developement and Geography of the Oligocene Period in Western Europe. Dr. W. T. Ord, Chairman of the Section, presided. The lecture was illustrated by diagrams. The general land and sea boundaries of the period were displayed, and the evidence for the general uplift of North-Western Europe, which commenced in the later part of the period, accompanied by the foldings along the old Armorican lines of weakness, which have specially resulted in our ranges of chalk hills.

Stages in the Building of the British Isles. On April 19th, 1913, the Rev. H. Shaen Solly delivered a lecture on this subject, illustrated with diagrams chiefly taken from the recent work of Mr. S. T. Jukes Brown. That these Islands are a depository of an almost complete series of strata

of all geological ages was shown to be due, in some degree, to their position on debateable ground between land and sea, a condition which has lasted for ages, though the sea has not always lain as now to the westward.

Barton Cliffs. The first excursion of the season took place on May 24th, when Mr. H. St. Barbe conducted a party of the Section in an examination of the exposure of chiefly the Middle Barton beds, lying between Chewton Glen, where the section was reached, and Barton Court. This part of the cliff contains the richest fossil zones of this well-known series. Some of the party worked the much tumbled undercliff, whilst others kept to the beach. On arrival at the Milton Station Hotel, where tea was taken, a fair number of the typical species was ascertained to have been collected, including several fine specimens. Owing to the measures taken in hand to combat the very serious coast erosion at this point it is probable that this classic ground will in future be closed to the geologist. This fact adds very materially to the importance of the recent acquisition by the Society of the Dent Collection, which was largely made along this section of the coast.

Durlston Bay. On June 14th the Chairman, Dr. W. T. Ord, conducted a party along the exposure of the Upper, Middle and Lower Purbeck strata in Durlston Bay, which were examined in succession, and their various features explained. The large Dinosaur footprints on a slab of Upper Purbeck, near the Coast-guard Station, were seen, though the passage of many modern leather-shod feet was seen to be rapidly effacing them. The mammal bed was located and eagerly searched, of course, without result. Some unusually large blocks of gypsum were seen on the beach near the zig-zag path, fallen from the Lower Purbeck. This excursion was of considerable interest and much enjoyed.

Aust Cliff, Severn Estuary. An excursion was arranged to visit the well-known exposure of Upper Triassic, Rhaetic, and Lower Lias beds of this classic locality. On July 4th Dr. W. T. Ord gave a preliminary account of the section at a meeting at the Society's rooms, and exhibited some of the typical fossils from his collection. On July 9th a small party journeyed to Bristol, and thence by motor-brake to Aust, accompanied by Mr. W. H. Wickes, of Clifton, who acted as director. The short, but extremely interesting, exposure was examined as thoroughly as time permitted. It consists at the base of the red and "tea-green" marls of the Trias, succeeded by the entire Rhaetic series and crowned with the lowest beds of the Lias. Much collecting was done from the fallen blocks of the Rhaetic, especially from the celebrated bone bed. The period is that of

the incoming of a sea swarming with the earliest great reptilian forms over isolated lagoons formed on the old desert-lands of the Trias. Mr. Wickes' assistance, and his detailed description of the section, were of the highest value and were greatly esteemed.

Dulcote Hill, Wookey Hole, and Ebbor Rocks.

On August 27th a strong party journeyed to Shepton Mallet and thence by motor-brake to Wells. On the way Croscombe Church was visited, and Dulcote Hill was ascended. Mr. H. E. Balch, F.S.A., of Wells, who had joined the party as director, here gave a description of the structure of the Southern Mendips, on the outward fold of which the party stood. The region displays the successive parallel lines of upheaval and the transverse faults nearly always found in connection with that formation. The drive was continued through Wells to Underwood quarry, where was seen the Dolomitic conglomerate, or shore deposit of the Triassic sea, formed by the waste of the carboniferous rocks which stood as islands in that sea.* Shortly beyond that point Wookey Hole and the neighbouring Hyæna Den were searched. Br. Balch gave an account of some of his researches in the Mendip caverns. At first as to their successive formation, development and subsequent degradation into open ravines, and afterwards in regard to their occupation, whether by wild beasts or by primitive man, down to the period of the Roman occupation of Britain. This was followed by a thorough exploration of the vast ramifications of the great cave. Afterwards the party walked to the Ebbor Rocks, a gorge similar in origin and upheaval to the more celebrated Cheddar Cliffs. Returning to Wells, where tea was served, Mr. Balch afterwards showed some of his discoveries in the Museum, they were chiefly illustrative of the prehistoric occupation of the Mendip caves. The excursion was one of varied and absorbing interest, heightened by the admirable descriptions given by Mr. Balch, to whom the heartiest thanks were rendered.

Swanage Bay. Ballard Down, and Studland.

On September 10th a party, under the direction of Dr. Ord, journeyed by steamer to Swanage, and, proceeding northward, examined in succession the Wealden and Neocomian strata of Swanage Bay and Punfield Cove. Ascending to Ballard Down thence to Handfast Point the series of chalk stacks were seen, then crossing the Down to Studland, the junction of the Chalk and Lower Tertiaries, as well as the coloured sands of the Bagshot series, the counterpart of those at Alum Bay were observed. The mode of stack, pinnacle and cavern formation in chalk was studied with much interest, and explained by the con-

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* See Dr. Ord's paper, "The Geology of Cheddar," Proc. vol. iv., p. 90.

ductor, who also gave an account of the physical geology of the Purbeck area from the summit of Ballard Down, where one of the most extensive and magnificent views in Dorset is to be obtained.

NOTES ON THE WORK OF THE GEOLOGICAL SECTION FOR SESSION 1912-13.

There were fewer meetings than usual held during the Winter Session, owing to the illness of one lecturer and the withdrawal of another. Also the Chairman's time and energy were much expended upon efforts to secure the Dent Collection of Barton Fossils, which, owing to the generosity of members, have fortunately been brought to a successful issue. It is hoped that monthly meetings will be held regularly this winter. Both the lectures and excursions of the past year were well attended, and the interest of members in geological subjects seemed to be well maintained. The number of members belonging to the Section, according to Rule 17, has been 50.

At the Chairman's request, Mr. H. St. Barbe has kindly consented to act as Honorary Secretary to the Section, and his services have already been of great value, and have much lightened the work of the Chairman.

The most important event of the past year, not only to the Geological Section, but also to the Society as a whole, has been the purchase of the Dent Collection of Barton fossils, the possession of which gives to the Society's Museum an importance which will redound to its credit in scientific circles. The Chairman takes this opportunity of heartily thanking all those who generously responded to the appeal made for funds. The collection is now the property of the Society, for, though an appeal was made to the public, there was practically no outside response, and the whole sum—with the exception of a few shillings—was subscribed by members of the Society alone. The thanks of all are especially due to Sir Daniel Morris, who devoted much time and energy to the matter, and without whose aid the purchase could hardly have been carried through.

The next event of importance has been the commencement of the work of displaying the geological collection of the Society. The Council have had four Museum cases constructed, which are now in the Society's room. The design of these cases was prepared by the Chairman, in consultation with the former President, Dr. Smith Woodward, of the Natural History Museum at South Kensington. It is believed that they are the best that can be obtained for the purpose with the funds available. To display the Dent Collection adequately, at least six such cases will be required. It is proposed at present to exhibit a selection from this collection of the most important specimens in two cases, in the hope that funds will shortly be available for the remainder. A beginning in

arranging the general geological collection has been made with leaves and plant remains from the Bournemouth Cliffs, which have been placed, preparatory to proper naming and arranging, in one of the cases. Of these specimens two-thirds have been collected and presented by the Chairman. Mr. Sherring and several other members have kindly contributed the remainder. It is believed that adequately to arrange and display the whole of the geological collection of the Society (excluding the Dent Fossils) at least twenty more museum cases will be necessary. No doubt the Council will, so far as funds permit, purchase further cases from time to time, but it will be several years before the needful number could be obtained in this way, and it is probable that an appeal may some day have to be made to the members for funds to supply this deficiency. Another difficulty will be providing space for the museum cases. The Society's room is much too small, unless it were given up entirely to Museum purposes and another obtained for sectional meetings. Thanks are due to all those who have kindly contributed specimens to the geological collection during the past year, especially to Mr. Sherring, Mr. St. Barbe, Mr. Grey, Mr. Morden Bennett, the Rev. T. S. Ross, Miss Buckland, and Miss Laidlay.

Zoological and Microscopical Section.

CHAIRMAN (1912-13): H. B. WELLS, F.R.M.S.
SECRETARY: J. OMER-COOPER.

Dec. 7th, 1912. A lecture was given by Mr. Aubrey Edwards. A report of this appears on a later page.

Feb. 8th, 1913. The Chairman of the Section, Mr. H. B. Wells, F.R.M.S., exhibited slides of organisms found and mounted during the Session, 1911—12, and gave the life history of several of them, specimens of which were afterwards exhibited to the audience under the microscope. These included *Artemia salina* and its fresh-water relative *Chirocephalus diaphanus* (see note by Mr. Waddington, Vol. IV., pages 57, 58), *Lernia branchialus*, *Serpula contortuplicata*, and the hydroid zoophyte, *Hydractinia squamata*.

Mar. 6th, 1913. A lecture was given by Mr. Richard Beck on "A few of our English Beetles." This lecture was very profusely illustrated by large diagrams. The lecturer first described the benefits derived from the habits of many of the beetle tribe, who devour and bury decaying animal and vegetable matter; then the destructive habits of others. Next came a description of the different organs of beetles and their uses; the life-history of many of the tribe was sketched,

and the lecturer finished with an exhibition of apparatus necessary for catching beetles, and of things needful for setting and preserving specimens.

April 17th, 1913. Mr. Charles J. Parmiter lectured on "The Life-history of a Coral." The Hydrozoa and Anthozoa were compared, then the "Simple" and "Colonial" corals were described, also the development of corals, and then coral reefs and their varieties. The lecture was illustrated by a series of diagrammatic lantern slides.

EXCURSIONS.

May 7th, 1913. An excursion to Brockenhurst, conducted by Mr. Richard Beck, to show how and where to catch beetles. Members were taken to Balmer Lawn and Stubby Copse. A very pleasant day was spent in the Forest, but, owing to chilly weather, not many beetles were taken.

June 21st, 1913. The members of the Microscopical Section paid a visit to Jumpers, or Oak Avenue Pond, with the usual result: a profusion of *Rotiferæ*, etc., and a good collection was made. In the stream, and on the banks of the river at Iford Bridge, immense numbers of the flies and larvæ of *Simulian* were found, and many taken for examination.

July 18th, 1913. A joint excursion was arranged by the Botanical, Zoological, and Microscopical Sections. The excursion to Hatchet's Pond is always popular, as the scenery is beautiful and the pond full of life. It is especially noted for the occurrence of many species of *Daphnia*, these being found in great numbers and often finely developed.

Photographical Section.

CHAIRMAN: G. BRUMELL, A.R.I.B.A.
SECRETARY: EDWIN DODSHON, LL.B.

Two meeting were held during the winter session. At the first, on December 12th, on the resignation of the Chairman, Mr. E. W. Barlow, Mr. G. Brumell was nominated as chairman. A general discussion was held as to the future of the section, and it was generally thought advisable for the section to devote itself primarily to record work and to illustrating the work of the other sections. A circular was sent to all members of the Society asking those who were willing to do actual work to communicate

with the Chairman; in reply to this a few members expressed their willingness to make lantern slides or to undertake the preparation of negatives of desired subjects. With the idea of giving some help to these members, the second meeting of the session was held on the 27th March, when Mr. Banks kindly described his experiences in "The Photography of Small Objects." This was a most instructive talk, in which those present benefited by Mr. Bank's description of the results of his ripe and wide experience in photographing flowers, plants, and similar small objects, indoors and out. Two excursions were held, the first on June 7th to Poole, in the hope of finding some picturesque views of antiquarian interest. Very few members turned up, however, and very little work was done. The second excursion was on August 9th to Swanage, in conjunction with the Archæological Section. This was arranged by Mr. Dodshon, the Secretary of the Section, to whom many thanks are due for the enthusiasm he has shown in helping with the work. Unfortunately heavy rain prevented any photographic work being done, and reference should be made to the Archæological Report for an account of this most interesting excursion. It is hoped during the winter to show, by lantern slides or prints, the best of the photographs that have been taken on the various excursions of the Society, and, if possible, to secure the reading of papers on modern photography in relation to scientific work.

Physical Section.

CHAIRMAN: HUBERT PAINTER, B.Sc., F.C.S.

SECRETARY: CHARLES J. PARMITER.

Radium and Radio-activity. The first meeting was held at Granville Chambers, November 28th, 1912. The chair was taken by Mr. Michell, Hon. Secretary of the Society, and the first business was the nomination of a chairman for the Section for the year. The retiring Chairman (Mr. Hubert Painter) was nominated for the position. He appointed Mr. C. J. Parmiter (to whose services the Section and its Chairman were so much indebted during the preceding session) as Hon. Secretary of the Section, and then proceeded to read a paper on Radium and Radio-activity.

Coal Mining. On February 22nd, Mr. J. H. Scott, M.E., M.I.M.C.E., gave a lecture, well illustrated by lantern slides and numerous specimens, before a crowded audience at Granville Chambers.

Discussion. Special Discussion Meetings, under the auspices of the Section and in connection with Mr. G. P. Bailey's Oxford University Extension Lectures, were held on February 10th and 24th, Mr. C. J. Parmiter presiding.

Spas of the Bournemouth Cliffs. On April 10th the Section met at the Municipal College to hear a lecture from Mr. Geo. Brownen, F.C.S., on the "Chalybeate Spas of the Bournemouth Cliffs." A report of this lecture appeàrs on a later page.

Excursion to Poole. The one sectional excursion of the season occurred on July 9th, when about 35 of the members spent a very interesting afternoon at the Pottery Works of Messrs. Carter and Co., Ltd., Poole.

A Selection from the Papers read before the Society.

A Comparison of some of the Diseases occurring in Animals with those which affect Plants.

By Geo. G. Hamilton, M.B., F.R.C.S., F.R.H.S.
Deputy Chairman of Council.

(Delivered as a General Lecture in Trinity Hall, on November 30th, 1912).

DR. ROBERTS THOMSON, ladies and gentlemen, as a Surgeon it was necessary for me to have an intimate knowledge of those diseases of man and the lower animals, which are caused by minute fungi or bacteria, and I had the very great advantage of spending two years in my brother Professor Hamilton's pathological laboratory, and afterwards of studying for four years under that great bacteriological surgeon, Lord Lister.

I am speaking now of 35 years ago, and at that time plants were not thought to be at all susceptible to the ravages of these minute fungi, and, in fact, about plant pathology there was very little known.

Four years ago, when I came to Boscombe Place, my study of patients gave way to the study of plants, and it is a kind of

popular review of that portion of animal and plant disease caused by minute fungi that I am going to put before you this evening.

A fungus may be defined as a plant devoid of stem and leaves, consisting of elongated cells, or of rows of these united in threads.

The spore, or seed, is the all important part, and for its protection the fungi assume their various shapes.

The little umbrella or pileus is covered with a thick skin entirely for the purpose of protecting the spores which are arranged underneath, either in the form of gills or as pores through which the seed protrudes when it is ripe.

You may say, what is the use of these fungi? Well, you cannot look at these drawings without noticing that, like the flowers, they have considerable artistic value, and when you come to their more intimate study, you will find that they are all important in removing and changing putrescent vegetable matter, just as flies and rats remove putrescent animal matter.

They have also edible properties, although they are not very nutritious.

There are about 30,000 naked-eye fungi, with the general characteristics of which many of you are more familiar than I am.

The interest created by our fungus forages will soon lead, I hope, to a study of the life history of the microscopic as well as the naked-eye fungi. I would now point out that the soil in which the spore is placed is the next important matter.

The fungi found in a beech wood are entirely different from those found in a fir wood, and the one which grows on the beech will not grow on the fir, and *vice versa*, and you will see that this matter of soil holds good when we come to study the microscopic ones.

The spores of naked-eye fungi are carried, for the most part, first by the fungus itself, and the elevated position of the fungus is really for the purpose of raising the sporing portion above the surrounding leaves, etc. The stinkhorn tribe distribute their spores by a "Jack-in-the-box" method. One of the group, which has been seen to grow four inches in an hour and a half, elongates by the release of the compressed cells of its receptacle.

Winds and water also carry the spores, and when we come to look at the animals which carry these spores, we find that horses, cattle, rabbits, squirrels, pigs, flies, wasps, beetles, birds, are among the chief agents.

The digestive juice of the slug is the most important medium in which some spores will germinate, and when you think that birds are fond of slugs, you can see how these spores are carried from one place to an entirely different locality.

Most naked-eye fungi have their spores arranged either in what is known as an ascus, a kind of little bag with as a rule 8 spores in it, or as a basidium, on which is placed 4 little stalks with the spore at the end.

It is the minute, microscopic fungi, the schizomycetes, or those that propagate by simple division, that we specially consider to-night. You know them as microbes, bacilli, bacteria.

For the most part they are either moulds or yeasts, and I wish to show you that they cause disease in plants in exactly the same way as many of you already know they cause disease in man and animals.

They are very minute microscopic fungi, and Professor W. B. Bottomley described in a lecture in Bournemouth a few days ago, how he estimated that from 30,000,000 to 50,000,000 of them could lie on a postage stamp, another reason for not carrying out the stamp-licking details of the Insurance Act.

They vary in shape, some (the micrococci) being mere dots, others short rods, while still others are spiral or are furnished with fine processes (flagelli).

According to the soil they live on, they used to be divided into saprophytic, or those which live on dead material, and parasitic, or those which live on the juices of living plants or animals, but these terms were not found to cover the whole ground, and pathogenic, or those which cause disease, and non-pathogenic, or those which do not cause disease, are now recognised as more suitable terms for their classification.

Some live better in an atmosphere of oxygen, others in an atmosphere of hydrogen.

Sunlight has a deadly effect on most, a dark cupboard or damp cellar being their happiest habitat. Many of them produce colour chiefly by means of their spores, and some secrete fetid gases.

They are recognised by their mode of growth on various gelatines, agar agar, and such like, and whether they liquify or not, such a culture medium is an important agent in their identification.

In fact, the pathologist sows these fungi of disease on his culture medium and recognises them very much as the gardener sows turnips, carrots or lettuce.

The making of wine, and no doubt the drinking of it, were known to the ancient Egyptians long before the time of Christ, but it was not till Schwann discovered the yeast fungus in 1838 that anything was known about the cause of the various changes which occur during the process of wine making.

Later, Pasteur went to a meeting of the Academy of Sciences in Paris and stated that the yeast fungus was the cause of the fermentation of grape sugar in grape juice. They laughed at him, but he produced 2lbs. of Algerian grapes and said to them: "Here are two flasks, you shall take one and I shall keep the other. Into your flask you can press the juice of *your* lb. of grapes, and into mine I will do the same, the only stipulation I make, is that you should allow me, with a clean silk handkerchief, to carefully wipe the stalks and skins of my grapes, on which the yeast fungus lives. We shall meet here in a month,

when *your* grape juice will have fermented, and *mine* will not have undergone any change."

At the end of a month, sure enough, a very great change had taken place in the flask which was not Pasteur's, whereas in his, the grape juice, instead of being turbid and mixed with a dirty slime, was clear and unchanged.

This process of fermentation, or the power of splitting up complex into more simple bodies, is possessed by many fungi other than yeast.

Pasteur's researches laid the foundation of Lord Lister's work chiefly on the putrefactive organisms. I can only remind you of a very small number of Lord Lister's experiments—experiments which ultimately led to the saving of millions of lives.

One, which I know he himself valued greatly, he was fond of showing us. He wanted to prove that beef tea could be exposed to the air as long as you like without its undergoing putrefactive change, provided the dust of the air to which the minute fungi were attached did not reach the beef tea. A flask (glass) had the neck drawn out into a number of curves, so that the air could reach the beef tea in the flask, whereas the dust was trapped in each bend of the neck of the flask, the result being that Lister kept this beef tea absolutely unchanged for 10 years.

Extending his researches further, he kept an amputated leg in a sterile condition simply by taking care that no fungi reached it.

All the wonderful results in connection with Septicæmia, or wound fever, are based on these and other experiments.

Now let us look at some other diseases caused by minute fungi. Typhoid, Diptheria, Anthrax, Cholera, Tubercle, Pneumonia, Glanders in horses, and many others are nothing more than a train of symptoms resulting from a process of fermentation in animal juices, the various minute fungi splitting up complex into more simple bodies known as toxins, which, acting like so many alcohols, produce their respective diseases.

In man there are four factors principally concerned in infection: (1) an abrasion, or point of entrance; (2) a depressed vitality, such as is produced by alcohol; (3) bad hygienic surroundings; (4) the Microbe.

Exactly the same essentials will be found in the case of plants if over watering is substituted for an excessive indulgence in alcohol.

It must be remembered that there are "friendly" microbes as well as those that cause disease.

There is plenty of free nitrogen in the air, but protoplasm cannot assimilate it without the aid of these minute fungi. Our digestion could not go on without them, and organic matter would not be destroyed.

How, then, are we to protect ourselves against the ravages of these minute fungi. Fortunately, they soon use up the food

on which they live, and, as in the case of yeast, the very alcohol which they form is very deadly to them.

I notice that whenever one talks to those who have not studied the matter much, that at once they say: " Kill them with chemicals." This would be all right if organisms existed, like green fly, on the surface, but when you consider that every small lymphatic is packed with myriads of these minute organisms, you will see that it is impossible to get at them, and chemicals only lower the vitality of the body cells, which are trying their utmost to resist the infection.

Prevention, or a wide cleanliness, is what is wanted.

Our grandmothers and mothers, I am afraid, taught us quite erroneously. Mud, for instance, is quite a clean thing. I used to be quite satisfied that a wound of a navvy's hand would be all right if it was covered with good, clean mud, but let that man be a gardener, or get his wound in the street with horse dung and, possibly, Tetanus bacillus admixed, then he would run a good chance of losing his life. You may wash as you like, you cannot clean your skin. Look into a modern Hospital, and you will get a good object lesson in wide cleanliness, for not only can a hose be put on any part of an operating theatre, but there should never be an ashpit outside, or, indeed, any putrescent matter capable of being carried by flies, etc.

Dust has been defined as matter in a wrong place, and nothing puts it in a wrong place better than the ordinary Spring cleaning. The method of cleaning a railway carriage (I should call it dirtying) is all wrong.

I got into a railway carriage at a London station the other day to find a porter in thick moleskins (a beautiful material for carrying dust), who had just finished " cleaning." I was quite unable to see for dust whether anybody occupied the far seat or not.

Abroad and in America the porters wear washable overalls, and the carriages are hosed out at the end of each journey.

We made some experiments in railway carriages, and found tubercle and other organisms in multitudes, especially in first-class carriages.

You constantly hear it said, " I got my cold from that open window "; fresh air never gave anybody a cold, it may give you a stiff neck, but a cold or pneumonia is contracted from person to person, and where you congregate people in public places, extra precautions must be taken to protect them.

Phagocytes or the little white cells of the blood, about 8,000,000,000 in a tablespoonful of blood, protect us by devouring these bacilli and throwing out a poison, an antitoxin, and lastly various vaccines protect us.

Many insects are killed annually by parasitic fungi, the mildew is often noticed round an insect on a window pane.

Plant and Animal Bacterial Disease Compared.

Of recent years much more research work has been carried out in plant pathology, and many more plants have been found to suffer from diseases caused by minute fungi than were formerly dreamt of. The higher plants suffer most, and every flowering plant has one or more fungi which prey upon it.

Massee estimates that the annual loss on cultivated plants due to fungi is at least £2,000,000,000. The Prussian statistics bureau gives the loss on cereals from rust alone as £20,000,000.

In the United States the loss on bitter rot in apples is estimated at £2,500,000.

Some of them act very quickly, and kill their host. *Pythium*, the "damping-off" of seeds causing death of the seedling in about four hours. "Smut" in the oat is present in the soil, affects the seedling, and the Mycelium or spawn grows with the seedling and lies dormant till the ear is formed, when, passing into the ear, it forms the black powdery mass, which prevents the proper formation of the cereal.

The "Smut," or spore, is cast on the ground to await the next year's seedling, when a similar infection takes place.

Phytophthora infestans (potato disease) has summer and winter spores. You can notice a large black patch on the leaf of a potato, and around this the summer spores soon appear like a white mildew, at the same time the spawn grows down the plant and enters the young potato, and there, forms a hibernating mycelium, scarcely recognisable in the potato, but always ready to form summer spores in the plant of the potato the following year. This fungus, finding that the market gardener distributes these young potatoes all over the world, has ceased to form winter spores at all, and depends on this hibernating spawn, a very curious instance of adaptation to surroundings.

Another curious instance of adaptation to surroundings is that when some saprophytes or those that feed on dead material, are fed solely on the sap of plants, they can be educated through several generations to become parasitic, and ultimately to attack the new host plant without the assistance of artificial food stuff.

Most plant parasitic fungi, just as we saw in animals, require an abrasion, or small wound, before they gain an entrance.

The surroundings, similarly, must be suitable, in fact, the potato disease has been shown at Kew not to grow unless the surroundings are hot and damp.

The host must be run down, over-watering being a common cause, and you must have the special fungus or microbe.

It will be seen, then, that wood, leaves, and other organic dead matter, or a living plant which is in a depressed condition, are necessary for the existence of these microscopic fungi, and when, in the Autumn, a plant is weak, or when it is growing rapidly, as in the case of the seedling, are the dangerous times, just as we have typhoid in the Autumn and tubercle in the young.

Mildew is a loose term, and includes Blight, Brand, Bunt and Rust, and is found even on glass. Most are white, but some are black, as corn rust (*Puccinia graminis*).

It enters by the stomata of the leaf, and eight days after infection little yellow spots appear, spherical, flask-shaped enclosures then follow with short rod shaped conidiophores. The barberry was supposed to be the cause of this fungus, but this is not the case, as the spores hibernate.

Dry Rot (*Merulius*).

My attention was drawn the other day to an unoccupied house in Bournemouth, where, in the hall, there was the most beautiful fructification of this fungus, one piece, the size of a soup plate and two inches thick, had around the edge numerous cup-shaped portions, some as large as an eggcup, and the greater portion was covered with minute spores like iron filings. When I went down to the cellar below I was able to trace the white mycelium right along the whole of the woodwork, and no doubt in time this would fructify.

Much of the fructification we see, such as *Polyporus* in the form of a biscuit, has a spawn right through the trunk on which it grows, and which will ultimately destroy the whole of the wood of the stem. It has been estimated that it takes seven years to destroy a firtree.

Streak in the Sweet Pea.

Chittenden's recent experiments at Wisley, on streak in the sweet pea help us to illustrate how fungi will invade a plant.

Twelve young plants in pots were taken, six were inoculated with the fungus which causes "streak," nothing happened, but the vitality of all 12 was lowered by over-watering, with the result that the six that had been inoculated became diseased, whereas the six which had not been inoculated recovered. This disease can be introduced either from the leaves or from the roots, and the vessels of the plants become absolutely blocked with microscopic fungi.

Scab in Apples and Pears (I shew specimens of the fruit and tube cultures) has been thoroughly proved to be of bacterial origin, a mould, which is so often the case, grows along the side of the scab and masks the growth of the "fusicladium," which is the real organism of this disease.

Let us now turn for a moment to the study of Galls.

A gall is, as a rule, caused by a fly or other insect. The Oak Apple is the common one. A wingless fly crawls along a twig till it reaches the young bud, and here selects to lay its eggs, trusting to the growing cells of the bud to form a little house for the grubs when they are hatched. The grubs in due course come out of the oak apple, but this time as a winged insect, and this winged insect burrows into the ground to form a root gall,

and this time the grubs hatched out of this root gall form the wingless fly, which again crawls along the twig to make the oak apple. A wonderful instance of what is known as the alternation of generations.

There are twenty different kinds of gall forming insects on the oak alone. But the interesting part to us to-night is that certain fungi cause galls on plants and trees, the mere presence of these fungi, or chemical agents secreted by them seems to stimulate the cells of the host to become hypertrophied, and this may be either in a localized form, as in the bladder plum, or where the mycelium spreads along the twigs to cause what you all know as " witches' brooms."

Floral malformations occur when a fungus gall attacks the reproductive or flowering portion of a plant.

Irwin F. Smith, Pathologist at the Rockefeller Institute in New York, supplies us with some curious facts in connection with " crown galls " in the Paris Daisy, a kind of marguerite. He calls it plant cancer, and states that it is exactly what a malignant tumour of a plant might be exepected to be. The tumour is non-capsulate, its growth is peripheral, and it has a well developed stroma, consisting of vessels and fibres.

Secondary tumours develope, and these have a strong tendency to take on the structure of the part they affect, thus a stem tumour may appear in the leaves, but is composed, in great part, of the descendants of the originally infected stem cells. A bacterium (*tumefaciens*) has been isolated by him in pure culture, and some success has been obtained in inoculating fish with it.

We spoke of how we are to protect *ourselves* against the ravages of these minute fungi.

Let us look, in conclusion, how we are to protect our *plants*. Here, again, a wide cleanliness is what must be aimed at, young seedlings suffer most, therefore have your greenhouse light and well aired, and so arranged that you can turn a hose on it, whitewash often, and have your benches of slate often cleansed, or if they are of wood, cover them with ashes, which, having come from the fire, are sterile. Boil your flower pots and sterilise the soil or see that it is clean.* If you have a rose bed near fir trees, creosote or tar the trees, and, similarly, if you cut off a branch of a fir, tar or creosote the cut surface. I don't believe much in spraying with chemicals; prevention is better than cure.

The lecture was illustrated by diagrams, pictures and colour photographs (Lumiere's process), as well as tube cultures from animal and vegetable tissues.

The Swifts.

By Aubrey Edwards.

Read before the Zoological Section, December 7th, 1912.

THE Swift has always seemed to me to be the most wonderful of our British birds. It is not, as generally supposed, one of the Swallow tribe, but belongs to another family of birds, and is related to the Nightjars and the Humming-birds. It is the most highly specialised of our birds, and is developed for a life in the air. Its shape is very much like that of a fish; there are no projections to catch the wind, the streamlines of the body are perfect. Its weight is only 1½oz., its length 7½in., and the spread of its wings reaches the enormous comparative length of 15½in. It is quite a large bird as compared with the Swallow. It holds its wings stretched out in flight, not folded back like a Swallow. Its shape in the air may be likened to a slightly bent bow with the body forming the arrow. The colour, which looks black, is really a dark olive brown, all except the chin, which is white.

The scientific name, *Cypselus apus*, suggests that it is without feet, but some of those who have handled Swifts have reason to know better. The claws, all four of which point forward, are very sharp, and pierce the fingers of the incautious when the bird gets a good grip. And it won't let go. The best way to hold a Swift is to place the back of the fore-finger between the wings, with the tip of the finger pointing to the tail, and then to grasp the wings with the thumb and second finger. The bird is then quiet and harmless. The sole of the foot extends to the joint above. The feet are black, and the claws will bend double with the sole at the end joint of each toe. The feet are formed for clinging on to rocks and walls.

The nursery window of the Vicarage where I was born looked out on to the Church and Churchyard, and one of the earliest sounds I can remember is the joyous screaming-chorus of the Swifts as they flew round and round in merry rings between the Church and Vicarage—the most merry of all the summer sounds I know. The Swift has only one note, rather a harsh scream, but there is no monotony in the chorus. The joy of it is like children in the distance screaming for happiness. As the sound approaches the window *crescendo* and recedes *diminuendo*, it has that pleasing, wild quality of moving sound which marks the superiority of a church bell when properly rung over one that is stationary and struck by the clock hammer. A number of birds would gather together and fly in close order, with quivering wings skimming over the long roof of the nave, turning at the chancel round to the left and back to the Vicarage again and again, each bird screaming for joy. In a good year as many as forty pairs of Swifts would nest in or quite near the Church, and so

I have had better opportunities of observing these birds than most people, and have made nearly a lifelong study of them, and what I am telling you is mostly from my own observation. Most of the life of the Swifts is spent in the air. They do everything in the air except nest, lay eggs, incubate, and feed the young. They eat, drink, gather materials for their nests, and go to roost in the air. They settle nowhere except at their own nests. They never settle on the ground, though sometimes they fall down when they clutch each other in play. They can rise from the ground if there is head room and they are not disabled. I have released dozens by placing them on the lawn, and with a couple of flips they were off. But they could not rise in a small court-yard with high walls, or when they had fallen into long wet grass and become soaked.

They are, I think, the last of the summer birds to come and the first to go. They used to arrive in Herefordshire in the first week in May, most often on the 5th, and they left generally about the 11th of August. The white eggs, of which there are two or sometimes three, are laid at the beginning of June, and take nineteen to twenty-one days to hatch, nearly as long as a chicken. The young are naked and unsightly things, and are blind for about nine days after leaving the shell. They take six weeks to grow up, and never leave the nest until they go out and straight off to Africa. They do not re-enter the nest. They are then fully fledged, and their wings nearly as long as those of their parents. Their quill feathers are edged with a lighter colour, and they are beautiful, glossy birds. The Swifts come to Europe only to breed, the conditions in Africa being, or having been, unfavourable for breeding. They come back to the same nest year after year, they pair for life, as do all birds which return to the same nest, they have only one brood, and they leave as soon as the young are ready to go. The puzzle—why do these birds leave in glorious weather when there is plenty of food—is explained when we realise that they come only to breed. As soon as that business is over they depart, and the weather and the flies have nothing to do with it. In fact, so eager are they to go at the usual time that I am assured by other observers that they will sometimes leave their young ones to perish. I have not seen this myself, and I do not think it often occurs.*

The Swift lives on flies and other winged insects, which it catches in the air. It will not take food otherwise, it will not pick a fly off a church window, even though it is starving. It does not know how to. It drinks while flying over water by slowing down, holding its wings well up and dipping its beak in for an instant. It gathers for its nest blades of grass, petals of flowers, anything it can find floating in the wind. These it binds together with its glutinous saliva, and sometimes makes a neat

* Members will remember the late stay of many swifts in 1912, when the broods were late, and the parent birds remained to do their duty.

little cup of a nest. I used to take up a bag of white feathers and scatter them on the wind from the soundholes, and the birds were delighted. Sometimes there were no Swifts in sight at first, but soon they came in numbers and raced for the feathers. It was one of the sights we used to show to privileged visitors. The Church (Orleton, in Herefordshire) has a Norman tower and an Edward III. wooden broach spire, and at the top of the tower there were half-a-dozen nests into which I could see, with the aid in some cases of a mirror. The Swifts would come and rest at their nests for a while in the daytime, and then they would let me take them by hand, but as far as I can learn they settle nowhere else. A correspondent told me that when they were evicted from their homes in the Church at Cromer, when the nesting holes were filled up, they returned to the cliffs which they had used in prehistoric days. They generally build in holes and in the dark, but within the spire there was light enough for accurate observation, and I am one of the few people who have seen young blind Swifts being fed. This was done somewhat after the manner of pigeons. Only the hen bird feeds the young. Many an hour have I spent amongst the bells waiting for and watching the Swifts and taking notes of the days on which eggs were laid, hatched, etc. A mouse delayed me a whole year in one instance. I was watching one young bird to ascertain the time it took from leaving the shell to leaving the nest. It was growing well and beginning to get its feathers, when I found it dead with a small hole in its neck. It was some time before I could fix on the murderer, but, guided by the evidence, I laid a trap, and there, on the top of that Old Norman tower, forty feet from the ground, I caught two big mice, and put a stop to their career of crime.

The old Clerk respectfully hinted that I was insane. I don't think he meant his words to be understood in that sense, but he said that things were different now, but in *his* young days anyone who spent such a lot of time and trouble watching these birds would have been walked off to the lunatic asylum.

The eyes of the Swifts are large and of a beautiful dark brown. They are deep set in the head, for they must not project to catch the wind, but must have a clear field straight forward. The groove which is cut in front for this purpose is lined with black with no gloss about it, and there is a little tuft of upright feathers in front, the use of which probably is to turn the wind off the eyeball. The beak is a mere point to divide the air and feed the young with. The head is carried close to the body, but there is a crook in the neck which can be straightened when the owner wants to reach out for a fly. The mouth has a very wide gape, the corners of it coming down underneath the eyes. The tail is forked, but has nothing superfluous or merely ornamental about it, like the long tail feathers of the Swallow. It is the best working tail that could be designed,

and when spread like a fan the tips of the feathers are in a straight line. The bird makes great use of its tail when twisting and turning after flies. The Swifts are fond of playing the game of follow-my-leader. One will fly up to the eaves of the Church, cling to the wall for an instant, then fall away and off over the tombs, and the others in turn will do exactly the same, and they seem to be laughing the whole time. They will fly as near as they can without touching to anything that interests them, and I have often felt the wind of their rush as they passed, and once in the Churchyard I touched one with my hand. But I could never catch them with a landing-net, they were too quick, unless they were just entering their nests. The speed with which this was done was startling. As I stood under the Church eaves I would see a bird hawking above the level of the nest. It would then fly out some distance from the Church to get up speed, and then, when opposite to, though still higher than, its nest, it would swoop down below and shoot up into it. As it neared the nest the wings were gradually closed, there was a " whsh " through the air and the bird was inside the hole without the slightest attempt to pull up. I suppose they know that feathers make good buffers.

Cold weather will numb them, and if it continues will eventually kill them, but they are able to fast for a long time. I have had a Swift in the Church for five days before it grew weak enough for me to catch, and then when I had given it some water it flew away apparently none the worse. The Swifts have two parasites to plague them, one a small, flat, brown louse, which I am told bites horribly. I have not personally experienced this bite as there are some things which I prefer to take on trust. The other parasite is one of the Hippoboscidæ (*Stenopterix hirundinis*) nearly allied to the Forest Fly which infests the ponies in the New Forest, and much like the parasite which is found on grouse. They are uncanny, three-cornered creatures and can run backwards, forwards and sideways, and if you remove one from the Swift it will pull the feather out sooner than let go with its hooked claws. I found a Swift one day clinging to a corner of the roof of the nave and I knew that something was wrong, so I had a ladder brought and sent up a man to bring the bird down. And I took eight of these parasites off it and it went away rejoicing. But it had quite given up hope before and would have died.

But the most wonderful thing of all about the Swifts is that they roost in the air. At sunset on a fine evening they assemble and play about for some time, flying separately and darting about in all directions. Gilbert White, in his monograph on the Swift in the Natural History of Selborne, says: " Just before they retire whole groups of them assemble high in the air, and squeak and shoot about with wonderful rapidity." It is strange that he did not see what followed. They end in gathering into a flock with their heads pointing in the same direction and ascending in

large spirals into the sky out of sight, and at last out of hearing; for they generally scream the whole time. One can watch them with a binocular after they are out of ordinary sight, a compact little cloud rising and fading away in the darkness. And they don't come home till morning. They roost up there. At first all of them, but when the eggs are laid, the male birds only; and not on stormy nights. Now, ladies and gentlemen, I do not expect you to believe this—at first. I did not believe it myself. In the year 1886, out in the garden after dinner, my younger brother, Cyril Edwards, now Rector of Mottisfont, in Hampshire, said to me: "I believe those Swifts go up and roost in the sky." I said: "Oh, nonsense." "Well," he said, "there they are, you can hear them ,they are going up now, you just watch them, they go up out of sight, and I believe they roost in the clouds." We watched them in the dusk, and at last they disappeared from sight up aloft. I said: "This is very strange, and I must find out about it, but it will take more than one to do it. You have got to go away to-morrow, but next year if we are at home together we'll go into the matter and settle it." Next year, 1887, we were at home together, and one fine evening, after watching the Swifts up aloft at 9.10, I sat on a tombstone under the south eaves of the church, where most of the Swifts built, until 10.30. My father and my brother watched by turns on the north side. I could see the bats, the beetles and the moths against the starlit sky, but no Swifts returned. On several other nights I watched till 11, not quite continuously, but quite closely enough to make certain that none returned. If you have ever sat alone on a tombstone in a Churchyard for a couple of hours at night, shut off by walls and hedges from the rest of the living world you might begin to think, as the cold crept over you, that the old Clerk was not very far out after all. The conclusion, to anyone knowing the habits of the Swifts, is irresistible. They go up and stay there. What is the six or seven hours of a summer night to a bird with such powers of flight as the Swift? All it has to do is keep its head to the wind and its balance, no exertion is required, but, of course, the birds cannot sleep. I wrote to "Nature," giving an account of this discovery. My letter was published on October 27th, 1887. Other bird lovers were observing the same thing elsewhere, but my letter was the first, and so we got the credit. People say "Of course, they go and roost elsewhere, you can't prove that they remain in the air." No, I can't. Mathematical proof is almost impossible, but bearing in mind the fact that the Swift has never been known to settle in the daytime, except at its own home, the difficulties in the way of the theory that they roost in distant cliffs—the only reasonable alternative—are greater than that of their remaining on the wing during the night.

The hen birds come out to feed in the evening, and the males, just before they ascend, try to drive them back to the nest. You will see one bird swooping at another like a hawk.

" Go back to the nest and mind the babies, I'm going up on the spree." " No, I have not had enough to eat yet," and she escapes for another mouthful, but he is after her and brings her back, and then joins the others. It was Mr. W. A. Wichell, the author of " The Evolution of Bird Song," who explained to me the meaning of this performance. I had often noticed it, but had not seen its significance. Mr. Wichell published an interesting article in " Knowledge," June 1st, 1897, on " The Swifts' Night-Flight," in which he gives the credit of the discovery to us at Orleton. In 1890 I wrote a paper containing what I knew about the Swifts, and it was published in " Nature Notes," the Selborne Society's Magazine, in 1891, January-May, in the form of a letter to the late Lord Selborne.* This paper brought me some very interesting correspondence, among others, from the late Duke of Argyll, who asked me to find out what the birds were feeding on when they were hawking very high in the air. The answer was—*Ants*—winged ants on their mating-flight—no flies go so high.

But if the Swifts go up at night they must come down. Yes, but I have not seen them. Since I took to systematic observation of these birds I have had neither the health nor the resolution to get up at 3 o'clock in the morning and wait in the Churchyard to see them come down; but I have got two bits of evidence to lay before you. Mr. W. H. Hudson, in his book "Nature in Downland," says that, near Wells, he was talking to a boy about 14 or 15 years old, a farm labourer's son, born in Priddy, on the Mendips, and the boy said: " They screechers be curious birds. Did you ever hear, zur, that they be up flying about all night and come back in the marning? " Mr. Hudson asked him if someone had told him that, and he said "No," he had found it out for himself. Morning after morning he had noticed, just after sunrise, that a number of Swifts suddenly made their appearance at the same spot, not far from a field that he had to watch. The birds would appear first at a great height, and rush straight down as if falling from the sky, until within a few yards of the earth, when they would dash off in various directions, or begin flying about the village. " It struck me," says Mr. Hudson, " as extremely improbable that this most circumstantial story was invented by the boy."

Soon after coming into this part of the world, in 1912, I was told I ought to go and see Hart's Bird Museum, at Christchurch. So I went, and found Mr. Hart taking a party round and telling them many wonderful things about the migration of birds. Speaking of some of the long and rapid flights of some of the shore birds, he said there was nothing impossible about them, for the Swifts habitually spent the night in the air. I asked him how long he had known that, and he said, about

* A complete set of Nature Notes (now the "Selborne Magazine"), 1890-1912, is now in the library of this Society.

13 or 14 years. "Because," I said, "my brother and I were the first to discover that and to publish it." I asked him if he had often seen them go up, and he said, "Yes, often." "Now," I said, "I want to ask you one more question. Have you ever seen them come down?" "Yes, several times. I have counted them up, and counted them down."

Now that is as near as we can get to proof until we get an airship or aeroplane to stay up with them all night.

On the 12th of August the Swifts have usually disappeared. They go to Africa and spread themselves over it from the North to Cape Colony. When they were gone there was always to me a sense of loss both to sight and ear. The familiar rapid bow-like forms and the merriest of the summer sounds had departed, the first of our summer guests had gone South. As Rudyard Kipling expresses it:

> "There's a whisper down the field,
> Where the year has shot her yield,
> And the ricks stand grey to the sun—
> Singing—Over then, come over,
> For the bee has quit the clover
> And your English summer's done.

The Heathlands of South Hampshire.

By W. Munn Rankin, M.Sc., B.Sc.

Read before the Botanical Section, January 16th, 1913.

THE heathlands are the most characteristic feature of the Hampshire landscape. No other English county has so high a proportion of waste within its borders. In the northern quarters wide sandy heaths extend over the Bagshot sands and join with others in Berks and Surrey. On the east, where the outcrops of the Lower Greensand lie below the edge of the chalk downs, extend the wastes of Wolmer Forest. And on the south-west the New Forest is at once the most varied and picturesque among heathlands. Here the Hampshire heaths join up with the great wastes of Dorset, which occupy all the county, excepting the fertile slopes and bottoms of the valleys of several streams—the Avon, Stour, Puddle, and Frome—between the limits of the New Forest, the Purbeck Downs, and the Dorset Heights.

It is between Southampton Water and Dorchester that the heathland attains its finest development in this country, and at the same time shows the closest affinity to the great heaths of North Germany. The western half of this waste has been described with the utmost fidelity in Mr. Hardy's sketches of Egdon Heath.

The heathlands comprise, woods of oak, beech and birch, scrubs of holly and thorn, and heaths dominated by the growth of ling, *Calluna vulgaris*. The heathlands of the New Forest and

its immediate neighbourhood are found on a variety of geological outcrops and deposits. They occupy the greater part of the exposures of the Eocene sands: the fine Barton Sands, between Lyndhurst and Beaulieu, the Upper and Lower Bracklesham beds eastwards of Fordingbridge and towards the south-west, where they form the watershed between the Avon and Stour, and finally the Bagshot Sands. Beyond the Forest into Dorset the heaths are almost entirely on the hungry soils of the Bagshots. In addition the heathlands cover considerable areas of the wide sheets of ancient plateau and valley gravels, which form an irregular border around the central portion of the New Forest, where clays and loams are covered with woods and pastures derived from woods. Heaths on gravel occupy the high watershed in the north-western corner of the Forest, and spread broadly at a remarkably constant elevation, about 130 feet in two separate areas between Hythe and Lymington, there masking the naturally fertile Headon Clays, which, however, are uncovered in the sides of the Beaulieu and Lymington rivers.

Though the vegetation of the heathland is predominately heath, some considerable woods of oak and beech occur in the New Forest on the Barton and Bracklesham sands and loams, though in Dorset natural woods on the heath sands are far to seek, if not totally absent. The oak woods are either pure oak woods or mixed oak-with-beech. In either type the chief associates of the middle shrub stratum are birch, holly and thorn. The ground vegetation is poor in species and but little higher in grade than the heath outside. The growth of bracken in the open glades is generally remarkably dense. Hair grass, moor grass, and other heath grasses form the greater part of the scanty herbage. Bilberry finds the shelter of the woods more favourable to its growth than the open dry heaths, from which it is absent. The most striking feature of the floor of the heathy woods is the almost complete absence of flowers, others than those of ling and the heathers.

The New Forest is the scene of a contest between the oak and the beech for dominance. The beech is a late invader and is restriced as a wood-former to the south-eastern counties of England. It dominates the woodland of the chalk along all the lines of downs as far as the eastern borders of Salisbury Plain, having displaced except here and there the earlier ash woods. In the New Forest it also challenges the dominance of the oak on a soil which has no evident similarity to the chalk.

The heath scrub occurs on the borders of woods as belts of scattered oaks and beeches inter-mixed with birch and other associates of the middle stratum of the normal wood, and as areas covered by birch and holly, often with much yew, as near Sloden, scattered in a loose formation over the heath. This scrub on the whole appears to be a stage in the degeneration of the woodland into heath. Cases of the reverse change, where the heath is being naturally brought again under woodland, are confined to

the neighbourhood of pine plantations where self-sown pines have taken possession of much of the heath. Beneath the half shade of the growing saplings the heather is more robust in growth than in the open; doubtless as a result of the moderation of the harsh conditions of full exposure to the drying action of the wind and sun.

The heath proper is characterised by the remarkable dominance of ling. It prevails over extensive areas to the almost total exclusion of any plant of a similar size and similar demands for light and soil. It characterises a plant grouping which is one of the most stable. The heath association occupies the lowest position among the vegetation of our country. It is the ultimate phase towards which all others move when in degeneration, owing to the deterioration of the soil either by the washing out of mineral food and the finest particles, or by the accumulation of sour humus at or near the surface of the soil. A lower stage than the Calluna heath to which this might pass has not yet been observed in this country.

The conditions under which the heath exists are extreme. Though the rainfall of 30 inches in the year is adequate for ordinarily retentive soils, it is inadequate to supply a sufficiency of moisture to a soil that is coarse and open. During some period of the year, therefore, the soil of the heath is practically devoid of moisture, and the conditions are in effect those of the desert. The exposure to the heat of the sun and to the cooling and desiccating action of the winds, which pass unhindered and unchecked over the face of the heath, is extreme. The soil is dark, and has, therefore, a fair absorptivity for heat. It is also dry at times, and being largely composed of sand grains, then reaches a considerable degree of warmth. The soil is covered by a thin compact layer of dry peat, generally only an inch or so in depth, though in constantly wet places this may attain sufficient thickness to be worth flaking off as " turves " for fuel. Below the layer of dry peat are a few inches of dark peaty soil, through which the roots of the heath plants ramify, in the main, horizontally.

This dark root-searched layer is very often sharply marked off from the light coloured virgin subsoil by a " pan," or hard, ferruginous layer, which has been formed by the interaction of the peaty substances washed down by the rain from the surface with the iron salts common in the sand. The pan cuts off the vegetation from what store of water and food there might be in the subsoil, and so contributes to the impoverishment of the soil.

The heath soil is typically poor in any kind of soluble mineral substance.

The conditions determining the heath are thus the poverty in those mineral substances necessary to active plant assimilation, the lack and at times the almost total absence of moisture, and in a less degree the acidity of the soil, caused by the accumulated sour humus or peat. In a word or two, the master factors of the heath are drought, physical and physiological, and poverty.

Growth is, therefore, slow, and in the case of the species typical of the heath, the lings and heathers, stunted. The growth form is almost exclusively xerophytic, as is shown by the small size of the leaves, their in-rolling, the stunted growth of the stems, the great length of the roots, and the occurrence in them of mycorhizal fungi.

On the drier and fresher soils of sand or gravel in pits that have recently been dug for road metal, the Scotch heath, *Erica cinerea* is fairly well mixed with the dominant ling, and when in bloom in early summer is a beautiful feature of the heath. In damp places near springs or heath streams the cross-leaved heath, *Erica Tetralix* is mixed with the ling. In similar stations, on the heaths in the neighbourhood of Corfe and Wareham, the pretty Dorset heath, *Erica ciliaris*, occurs. Another, but more widely distributed, associate of much beauty is the marsh gentian, *Gentiana pneumonanthe*. Small tufts of the moor-gass, *Molinia cærulea*, hide much of the peaty surface layer beneath the ling and with it occur the creeping stems, with short erect spring branches, of the dwarf gorse, *Ulex nanus*. The abundance of this gorse, though generally quite unobtrusive, is one of the distinctive features of the South Hampshire heaths. The growth of the *Cladonia* lichens encrust old dry peat beneath the ling. These, together with the mosses, *Polytrichum*. sp. and *Dicranum*. sp. also play an important rôle in the preparation of bare soil for the occupation of higher plants. The common gorse, *Ulex europæus*, occurs on the heaths, but rarely away from the sides of the roads or foot tracks, its distribution being closely related in some way to human occupation.

Some rare associates of the local calluna heaths recall the heather moors of higher latitudes. These are the crowberry, *Empetrum nigrum*, which has been recorded for the heaths about Poole Harbour, but not within the borders of Hampshire, *Listera cordata*, *Lycopodium Selago*, and *Lycopodium clavatum*. It is just possible that these are relics of the heaths of an earlier cooler period.

The origin of the heath is a subject of great interest, but it can only be just touched upon at the present occasion.

The heath may originate in a variety of ways.

The loose sand of sand-dunes on the edge of the sea after a period of exposure to the atmosphere may, as at Studland Bay, pass over from the dominance of the marram grass into that of the ling.

Flats of shingle that have been long accumulated and drenched by rain slowly become inhabited by mats of ling.

The coarse sandy soil of the Bagshot Sands is naturally so devoid of plant nutriment as to be incapable of supporting any vegetation except such as makes the minimum of demand upon it. It is, therefore, highly probable that from its first uncovering it has been occupied by vegetation of the heath type. With other sands and gravels which contained on their first exposure a fair

amount of plant food the case is different. According to Mr. C. Reid, the region of the New Forest was covered at a fairly recent geological period—possibly Pliocene—with a wide-spread sheet of river gravel brought down from the chalk downs and even beyond these, from the exposures of Purbeck strata in the Vale of Wardour. These gravels must have been in respect of their fertility for some time after their deposition much like the present-day valley gravels of the Avon, upon which considerable crops of wheat and barley are cultivated. In the course of time by the leaching action of rain (and this may have been considerable during the Ice age) the fertility of the gravels doubtless deteriorated. Instead of carrying a vegetation of a higher grade, such as woods with a varied flora, the gravels successively supported a steadily degenerating series, ending in the heath. The penultimate stage was in all probability, if we may judge from what is seen to be the case to-day in the North German Heathand in the Highlands of Scotland, a wood or scrub of Scots pine. Although Scots pine is now one of the commonest timber trees of the Forest on the poorer soils it is as we see it to-day only a recent introduction, dating from 1774. The abundant evidence (submerged forests at Southampton, Bournemouth and elsewhere, and timbers and cones in peat bogs here and there within the district) shows that this tree grew on or about the heaths at an early period. It perhaps disappeared naturally as a result of the impoverishment of the soil.

Much of the woodland on the poor loams and sands is evidently but little removed from the heathland and it is very probable that considerable belts of such woodland have passed into the heath within historical times. More especially is this the case on the borders of the Forest towards Eling, where the confiscation by King William is known to have been very extensive.

The fate of the heaths is in many districts very uncertain. Until recently these wastes were as desolate a country as might be met with anywhere in the lowlands of England. The wretchedly poor soil afforded the scantiest of subsistence to cattle and was sparsely inhabited. This very unserviceableness to man has preserved the heathland.

Its ancient aspect contrasts with the trim, much civilised lineaments of the field and pastures that make up most of our country. To-day the heath is in great danger of losing its chief charm of remoteness and other-worldliness. The great pleasure town of Bournemouth replaces a sea-ward heath that had not been inhabited since the times of the late stone man. Villas, garden towns among the heather, on well drained and perfectly clean subsoil, will doubtless spring up along the great highways that traverse the heaths. Much will be lost, not only beauty of landscape, but also plant assemblages and plant species. The public sense of what is worthy of preservation has hardly yet grasped the importance of preserving examples of vegetation that have scientific and historic value. In this respect our country lags

behind Germany, where patches of moors or woods are preserved as natural monuments on much the same ground as an earthwork or a cathedral. It is fortunate, however, that the New Forest is a charge of the State and will be preserved for the enjoyment of visitors and residents for ever. The only fate to be feared for this sanctuary of nature is that of spoliation by too active naturalists who may visit it.

Townsend's Grass or Ricegrass

(Spartina Townsendii).

By Dr. O. Stapf, F.R.S., Sec.-L.S.

Delivered as a General Lecture at Trinity Hall, January 25th, 1913.

DURING the last forty years a grass made its appearance on the Hampshire coast. It came no one knows whence; it gained ground at first slowly and unobtrusively, then it spread all at once rapidly and, in places, to a truly amazing extent, so much so indeed, that it altered completely the aspect of wide stretches of the foreshore and the estuarine reaches of the rivers from Chichester Harbour in the East to Poole Harbour in the West. It was collected first at Hythe, near Southampton, in 1870, but mistaken for another grass until, in 1880, it was recognised as a distinct and new species by the brothers Henry and James Groves, who named it *Spartina Townsendii*, after Frederick Townsend, the well-known author of an excellent flora of Hampshire. Up to six or seven years ago it was rather a botanical curiosity. But when, in 1907, Lord Montagu, of Beaulieu, called the attention of the Royal Commission for Coast Erosion to the startling rapidity with which it took possession of the foreshore of Beaulieu River, and its possible use as a land reclaiming agent, it became soon an object of public interest, under the popular name of "rice-grass." This name had been picked up by Lord Montagu from some people who told him that a few years previously the grass was introduced accidentally by a ship that foundered in the Solent. There is, however, no confirmation of the story, nor is the name "rice-grass" appropriate, as the grass has nothing to do with any of the cultivated or wild rices. In books, it has also been called "Townsend's cord-grass," cord-grass being the English equivalent of "*Spartina*" (from *Spartum*, Latin for Esparto grass or a cord made from it). But this again is a misnomer, traceable to a confusion with a kind of rush used for making cords.

Townsend's Spartina, or Townsend's grass—as it might briefly be called—belongs to a small genus of grasses which are mostly natives of the Atlantic coast of America. Only one species, *Spartina stricta*, is really indigenous to Europe, where it occurs here and there in littoral marshes from Lincolnshire and

Holland to the Straits of Gibraltar, and in an isolated area at the head of the Adriatic. Two other species of well-known American origin have become established in Europe since the end of the eighteenth or the beginning of the nineteenth century, *S. juncea* in the Mediterranean and *S. alterniflora* in the innermost corner of the Bay of Biscay and in Southampton Water. Townsend's grass differs from all of them, and at the same time it has not been recorded from anywhere outside its English area, excepting two French stations near Cherbourg, where it has made its appearance within the last two or three years.

It is a vigorous, stout, stiff grass, standing usually about 2-2½ feet high, but occasionally much dwarfed, or drawn out and then attaining a height of from 3-4 feet. It grows mainly in the soft ground of the mud flats which are so common on the Hampshire coast and the adjoining portions of the coasts of Dorset and Sussex and in the tidal reaches of their rivers. It anchors itself in the mud by long vertically descending roots, whilst another set of roots, short but abundantly divided and interlaced, spreads all round from the base of the stems and the nodes of stolons close to the surface of the mud. It grows in tufts* which often assume great dimensions and a remarkably circular shape. Such circular patches, or clumps, may measure anything between 3 and 15 feet in diameter and even more. The grass owes this peculiar growth to the production of numerous underground branches or stolons, which grow out from the buried stem bases radially, and measure from a few inches to several feet. Inequality in the density of the mud, admixture of sand, pebbles or larger stones and other conditions may favour development in one or the other direction, when the circular shape of the clumps gives way to irregular shapes, or it may be that two or more clumps meet in the course of expansion and fuse, and finally many clumps may unite and form regular meadows with a dense matted growth. The leaf-blades are rigid, long and long-pointed, standing off at angles of 60 to 70 degrees, and bright green or slightly glaucous. Like all the Spartinas it has the spikelets closely arranged in stiff, one-sided spikes which spring from a common axis and are erect, so that they are almost or quite applied to each other. There are usually 4-7 of them, but starved specimens may have only two, and luxuriant specimens as many as eleven. The very pretty, feathery, white stigmas appear before the anthers, and persist a long time, apparently in a fresh condition. The grass begins to flower in the latter part of July, and the flowering is most profuse in August and September. Some individuals, however, lag much behind, and may be found in bloom as late as the end of December. As each spikelet contains only one flower, it also has only one grain, which remains tightly enclosed in its husks. The grain has a very thin shell and an unusually large, green embryo, which frequently grows out and pierces the shell,

*See plates I. and II. accompanying Mr. Sherring's note on Spartina Townsendii in Proc. Bournemouth Nat. Sc. Soc. iv., p. 49.

or pericarp. The spikelets become easily detached when ripe, drop into the water and leave the bare spindles standing up stiff like spears until they break down along with the stems, which gradually decay during the winter and spring. The ripening of the grains takes place mostly in October. Abundant as the flowering is year after year, the fruiting is very uncertain. In October, 1907, I found only few perfect grains of Townsend's grass in the Isle of Wight, whilst after the hot summer of 1911 there must have been millions of them in the Lymington beds alone. In front of the Pylewell Estate and to the east of it, there was, at high water-mark, a long band of chaff, which, on examination, consisted almost entirely of spikelets of the grass. A good handful taken up at random numbered 1882 spikelets, of which, however, only 193, or a little over 10 per cent. contained apparently sound grains. They were spikelets cast out. Most of those which had good grains must have sunk on the mudflats. Samples taken up from 1-1½ feet below highwater-mark showed a percentage of over 60 good grains in the 100. 1912 was again a bad year for the maturing of the grains. The bottom of the mudflats is overrun with a delicate film of filamentous Algæ, and it is by their fine threads that the spikelets when sinking are caught and gradually so fixed that they remain there until they germinate, when the seedling becomes quickly and firmly established by the rapid growth of the roots.

The presence of mud is an important factor in the formation of colonies of Townsend's grass. It need not be necessarily pure mud, although the grass is most generally and abundantly found on such, but if there is an admixture of shingle and sand it must not exceed a certain amount. As all the mudflats are formed in comparatively quiet waters, we find the grass confined to these and entirely outside the zone of heavy surf and strong tides. On the flats themselves the limit to which the grass can spread is determined by the depth at high tide. Although the grass can stand much submersion, 2½-3 feet of water at ordinary high tide seem to be the maximum it can bear. This 2½-3 feet line determines the outer limit suitable for the grass. The inner or landward limit lies close to, but still clearly below highwater-mark. This is also true of backwaters and the estuaries of rivers. Within those limits the grass has a practical monopoly in so far as flowering plants are concerned, no other species associating with it, except in places *Spartina alterniflora*.

The area occupied by the grass on the South Coast of England extends at present from the entrance to Chichester Harbour, near West Wittering in the East to the Southern and Western shores of Poole Harbour in the West, covering several thousand acres, the largest beds being those on the West side of Southampton Water, in Lymington Harbour, in Hurst Castle Bay, and at the mouth of Beaulieu River. The Spartina bed between Hythe and Calshot Castle, probably the oldest and the most compact, is about five miles long and 400-600 yards wide, and covers over

800 acres. That of Lymington is of a triangular shape, with a maximum length of six miles and a maximum width of almost one mile. Including the waterways and so-called "lakes," or open sheets of water, it may be estimated at between two and three square miles.

It has already been stated that the first record of Townsend's Spartina dates back to 1870, when it was collected near Hythe, but mistaken for the old English *Spartina stricta*. The extent of the Spartina beds near Hythe as they were then, cannot be estimated exactly, but they cannot have been either very large or old, as no botanist could have overlooked them. Later on, in the seventies and about 1880, it was stated by the brothers Groves to occur in considerable abundance on the mudflats above and below Hythe, where it was conspicuous among colonies of *Spartina alterniflora*. In 1883 it had not yet travelled beyond Cracknore Hard, two miles north of Hythe Pier, but in 1887 it was already recorded from Southampton. Then, towards the end of the eighties, something occurred that favoured the spreading of the grass. For in 1893 several strong patches of it were observed by the brothers Groves near Yarmouth, and in the same year it made itself noticeable at the mouth of Newton River. Two years later it was found by Stratton in little creeks on the west side of Medina River. All this was in the Isle of Wight. But it also travelled eastwards. In 1899 it was, for the first time, collected near Bosham and Chichester, in 1900 in Hayling Island and near Havant and Emsworth, in 1901 in Thorney Island. This was at the eastern end of the area. On the western side we find it first recorded from the Lymington area in 1903. Two years later Dr. J. Cosmo Melvill found the salt marsh near Keyhaven (in the same area) overrun with it, although nine or ten years previously there was no trace of it there. By that time it had also established itself in Beaulieu River. By 1907 it had run up the river to within half-a-mile of Beaulieu village, forming in places dense beds. In Poole Harbour it appeared in 1899, when Mansel-Pleydell pointed out a single small clump in the roadstead of Poole. In 1905 it was found in some quantity by the Fever Hospital, whereas in 1907 it was described as occurring in the Harbour in hundreds of clumps. There was then little of it to the south-east of Parkstone Bay, and the last clump was observed in a sheltered position where West Road comes down to the shore. To-day it has advanced almost to the Haven. In 1907 the clumps could be counted in Hole Bay. Since then they have multiplied enormously, and in many places run together. Mr. Sherring also traced it all over the western bays and creeks of Poole Harbour. The grass also occurs on the North Coast of the Isle of Wight, from King's Quay to near Binstead, in the Hamble River, and in a few other places on the east side of Southampton Water, and in Portsmouth and Langston Harbours. Some six or seven years ago a small colony was reported from Little-

stone, in the Romney Marshes; but, owing to the banking-up of the creek where it was found, it has since disappeared. The latest addition to the area was made by the discovery of some colonies in the estuaries of the Rivers Saire and Vire, in the Peninsula of Cherbourg, about 100 miles due South of the Isle of Wight.

The dispersal of the seeds is, no doubt, mainly due to the action of the water into which the spikelets fall when detached. Once in the water they would float about until waterlogged. Some would sink in the neighbourhood of the parent plant, but many would be carried by the tides or currents either to the shore or along the shore, or even across estuaries and straits before they sink, and, under favourable conditions, start, in due course, new colonies. Birds may also have been dispersing agents, although it is doubtful that they ever played an important *rôle* in that respect, except in so far as they may have carried spikelets to localities which, by the ordinary action of tides and currents, could not be reached. The same may be said of man and his shipping. But apart from seeds, dispersal may also take place through detached pieces of stolons, such as are found floating or cast out on the shore after heavy gales.

Various theories have been advanced to explain the first appearance of the grass in the English flora. The most plausible would seem to be that it was due to accidental introduction from a foreign country; but our present knowledge of the genus and its distribution does not support it. Another suggestion is that Townsend's grass arose as a sport or mutation from *Spartina stricta*, which formerly used to grow on the shores of Southampton Water. *Spartina stricta* is, however, a singularly uniform and conservative species throughout its area, rather receding than advancing, and slow in adapting itself to changed conditions. It is evidently not the material from which one might expect sports or mutations to spring, so distinct and vigorous as Townsend's grass.

There is, however, a third theory which is more plausible. According to it, Townsend's Spartina arose from a cross between *S. alterniflora* and *S. stricta*. *S. stricta* does not at present occur in the neighbourhood of Southampton or in Southampton Water; but we know for certain that it did so not very long ago. *S. alterniflora* is common in the Itchen River and also found in various places at the head and on both sides of Southampton Water. There was, no doubt, sufficient opportunity for the two species to hybridise. Unfortunately it has not been possible so far to produce artificial hybrids of *S. alterniflora* and *S. stricta*. The evidence in favour of this theory is, therefore, necessarily circumstantial. It rests partly on the structure and the general behaviour of the grass, and partly on the occurrence of a natural hybrid between the same two parents in another part of the world and its extreme similarity to Townsend's grass. As to structural characters, there is no doubt that

many of them may be considered as intermediate between those of *S. alterniflora* and *S. stricta*, although they are frequently, more or less, obscured by the remarkable readiness with which Townsend's Spartina responds to external conditions, now dwarfing down to the modest size of *S. stricta*, now running up to and even exceeding the height of fine examples of *S. alterniflora*. Similarly, its remarkable vigour, its pronounced instability, and its varying fertility, very much enhanced in certain years and almost suppressed in others, may be adduced in favour of the hybrid nature of the grass, as those conditions are traits frequently observed in hybrids. But the strongest evidence seems to be in the following fact:—*Spartina alterniflora* and *S. stricta* meet outside their English area only in one other place, namely, the estuary of the Bidassoa River, South of Bayonne, in the Bay of Biscay. There they grow intermixed, and among them has been found their hybrid. Foucaud described it in 1895, and named it *Spartina Neyrautii*, after its discoverer, Neyraut. Now this *S. Neyrautii* is so similar to *S. Townsendii* that Foucaud proclaimed both as hybrids from the same parents, explaining such differences as there are by the assumption that *S. alterniflora* was the female parent in the case of the Bidassoa cross, and *S. stricta* in that of the English plant. The fact is very remarkable, and the argument deducible from it for the hybrid origin of Townsend's grass has almost the force of experimental proof.

Thanks to its vigour and occasional fertility, Townsend's grass has, in a comparatively short time, conquered thousands of acres of bare mud-land, it has invaded and, in places, much reduced the beds of *Spartina alterniflora* in Southampton Water, and even attacked the marshes which so far have been the home of *Spartina stricta*. However, its principal domain is and will probably for ever be the mudflats from one to three feet below high water-mark. Here the changes brought about by Townsend's grass are remarkable. It is not only that the aspect of the flats is altered, the eye meeting great expanses of green comparable to meadows or cornfields, where there was previously a monotonous sheet of grey at low- and half-tide, also the animal life on the flats and their physical character is undergoing a change. To mention only a few economically interesting effects on the fauna: in more than one place the larger molluscs which were collected for food have disappeared; with the arrival of the grass, eel-spearing has been seriously interfered with, whilst even duck shooting has been spoiled owing to the birds finding a welcome cover in the dense grass belts. But the most important change concerns the physical conditions of the flats. It is obvious that the copious systems of roots and stolons must contribute to the stabilisation and solidification of the mud. In addition to this binding action the stems and lower leaves and leaf-bases act as a very effective strainer on the water, which is charged with solid particles brought down by the streams, catching and precipitating them. The result is an accelerated and increased

deposition of mud over the area tenanted by the grass. The level of the mudbank becomes raised, the mud itself firmer. Further, the decay of each year's growth enriches gradually the mud with nitrates and sulphides and other salts, and prepares it for the reception of types of vegetation which were until then excluded from it. On the landside of the Spartina belt, where there is only a foot of water at high-tide, a growth of *Aster Tripolium* and *Obione portulaccoides* springs up among the grass, the first heralds of the reclamation of land that has set in. If the process continues the muddy foreshore will gradually be replaced by *terra firma*. But another effect is more immediate, that of the protection which the grass affords to the shore behind it against the erosive action of the sea. The stems of the grass opposing themselves in their millions to the onrushing tides, to currents and the wind-driven sea act like a natural breakwater to the shore behind them. It might be feared that the grass would become a nuisance to navigation by blocking up the waterways, but this is not the case . Bound to shallow water, it is not likely to invade the deeper water channels. On the contrary, the consolidation and gradual elevation of the grassgrown flats along them tends to increase the scouring action of the currents and tides on the sides and bottoms of those waterways, making their banks steeper and increasing their depth.

There is no reason why artificial plantations of Townsend's grass, under conditions corresponding to those of its native habitat, should not be successful. Propagation by division is easy, and the grass takes on well and grows rapidly, as experiments made in the Medway River and in New Zealand show.

When the grass is young the leaves and stems are succulent and sweetish, and cattle and horses relish it. Several American species of Spartina are cut and fed to horses and cattle on a large scale. Analyses of Townsend's grass, made on behalf of the Board of Agriculture, show that for nutritious qualities it is quite equal to its American allies, and may be classed as a good average fodder grass. Other uses to which the grass has been put and might be put on a larger scale are for thatching, and, above all, for mulching. It has even been tried for paper-making, but with doubtful success.

The Native Plants of Britain and Germany: A Comparison.

By Miss C. Agnes Rooper.

Read before the Botanical Section, March 13th, 1913.

IN beginning my paper, I wish to say that the authority for the statements I am about to make is Herr Drude. This eminent German botanist, in company with other Continental

and American botanists, made a tour through the greater part of the British Isles during the summer of 1911. The tour was under the auspices of the British Vegetation Committee. Herr Drude's criticism on the British Flora in contrast with that of Germany was that, although it possesses but few indigenous plants which do not also belong to the German Flora, yet it is a very interesting one, for it represents the Flora of Germany at the close of the Baltic Ice Age, when the British Isles still formed part of the Continent and, consequently, shared its vegetation. After the separation had taken place and the British Islands had been formed their distance from the mainland had this effect on their Flora, that it remained purer than that of Germany which was so exposed to extraneous influences as to be much modified and altered by them. Examples of the survival of this very ancient Flora in all its integrity are not wanting, but are scattered here and there over our islands. For instance the shore of the Bay of Galway is covered with the shrubby Potentilla which is also a native of Germany and of Central Europe. Herr Drude in fact states it as his opinion that in modern times the conditions of vegetation over the larger portion of the British Isles are so uniform as to furnish the conditions for the development of characteristic forms in their somewhat extensive area from the general stock of the west and north European Flora which has been present or invaded these islands since the Ice Age. At least on the lower hills up to a height of about 100 metres a uniformity is apparent markedly differing from what we find in mid Germany in the English, Scottish, and to some extent also in the Irish Flora. The woods of the south and east English vegetation region show a striking deficiency as compared with those of the German plains and hills in the absence of *Pinus sylvestris*. This tree though very abundant on sandy soils is not generally regarded as a native in the south-east of England, though it was apparently general in early post glacial times. It owes its prevalence in some of the New Forest heaths to its introduction into Ocknell Clump in 1776, though there is some evidence of its much earlier occurrence in the district. In a general way the trees and shrubs of the British Islands offer a great difference from those of Germany. Our woods and coppices do not present the same variety as the German. In England there is lacking that delightful mixture of various trees offered by a mid German valley, where behind Alders (*Alnus glutinosa*, *Alnus incana*) absent from England, *Carpinus Betulus* (Hornbeam) is mixed with *Acer platanoides* (Norway Maple), *Ulmus* (Elm), *Tilia* (Lime) and others on the valley sides, giving place to Beechwoods with *Picea* and *Abies*, and making way for *Pinus sylvestris* (Scotch Pine) on the steeper and drier slopes. On the other hand our Heathlands, more especially those of the New Forest apparently possess a richer and more beautiful Flora than those of mid Germany. *Erica Tetralix*, *Narthecium* (Bog Asphodel) and *Hypericum Elodes* (Marsh St. John's Wort), the masses of which adorn our heaths are

absent from the German ones. The Flora of the North British Hills and Moors differs in spite of its numerous resemblances from that of Germany, in that many species grow on a far higher altitude than in that country, which is probably owing to our damp rainy climate and the absence of heavy long enduring snow falls. The Flora of our coasts is naturally far more interesting and extensive than that of Germany, for whilst our shores are very varied in their many natural aspects, those of Germany are limited for the most part to the flat sandy beach of the North Sea. Apparently the only plants of interest on that beach which are absent from England are *Linaria odora* and possibly one or two more.

The following are some of the plants found in England and not in Germany, with special reference to those growing in the New Forest:—*Thalictrum minus*, *Anemone nemorosa*, *Helleborus viridis*, *Aquilegia vulgaris*, *Corydalis claviculata*, *Hippocrepis comosa*, *Vicia Orobus*, *Vicia Lathyroides*, *Lathyrus montanus*, *Sanicula europea*, *Eryngium campestre*, *Bupleurum falcatum*, *Peucedanum palustre*, *Leucojum aestivum*, *Colchicum autumnale*. All these grow in the neighbourhood of Bournemouth.

List of some of the flowers found in Germany but not in England:—*Anemone ranunculoides*, *Ranunculus lanuginosus*, *Nigella*, *Aconitum Lycoctanum*, *Aconitum Cammarum*, *Corydalis cava*, *Genista germanica*, *Trifolium montanum*, *Coronilla varia*, *Vicia cassubica*, *Vicia tenuifolia*, *Lathyrus vernus*, *Lathyrus heterophyllus*, *Bupleurum longifolium*, *Seseli*, *Chaerophyllum aromaticum*, *Peucedanum Cervaria*, *Laserpitium*, *Lilium bulbiferum*, *Lilium Martagon*, *Anthericum Liliago*, *Anthericum ramosum*.

The list, of course, might be extended, but these few names will interest our members and may suggest a further comparison. Generally speaking Herr Drude, in his comparison of the Floras of Britain and Central Europe, remarks that although in some respects they are closely allied, in others they differ considerably. Numerous slightly differentiated local forms are endemic in England and many common species constantly polymorphic in their German stations appear to him to look very different in their English stations, and therefore to represent local endemism. Again as regards floristic distribution the same species are more uniformly distributed at lower altitudes over the whole country than is the case in Germany. It is not only indigenous species which show this, but introduced trees like *Araucaria imbricata* and *Acer Pseudoplatanus*, which grow as well in the north of the British Islands as in the south. Hence Britain furnishes instances of vegetational limits determined by developmental rather than by climatical or ecological conditions.

The Scales of Fish.

By W. A. Willes.

Delivered as a General Lecture at Trinity Hall, March 29th, 1913.

THE examination of fish scales with the aid of the microscope is no new study. So far back as the sixteenth century it is recorded that soon after its invention a man named Borello wrote a brief description of the microscopic appearance of a fish-scale, but nothing seems to have been done in this direction with regard to salmon and trout until recent times, when Messrs. Calderwood and Johnston, of the Scottish Fishery Board, Mr. J. Arthur Hutton, so well-known for his excellent work in the restoration of the River Wye to the position of a first-class salmon river, and others took the matter up, and, by a systematic series of research experiments conducted in parts of Scotland, obtained such a valuable insight into the life and habits of the salmon, as to make the study of its scales a most interesting and important work, inasmuch as by this study the whole life and habits of a salmon can be identified.

This research work has been the means of upsetting many theories formerly held, and should be the groundwork for future legislation in restoring our rivers to their former productiveness, and by this means, adding to the food of our country. In considering fish-scales let us first of all try and get a good definition of a fish—surely it is a vertebrate animal which lives in water, and breathes liquified oxygen by means of its gills, wherewith it oxygenates its blood. Then, what is a scale? This word, as we all know, has different meanings in our own language. We use it in the sense of climbing, in the sense of a balance, in the sense of harmonic or musical proportion, and in the sense of the outer covering of a fish; but in all its various applications it seems to be derived from a Saxon word signifying to divide—so that the scale of a fish is a divided thing, a part of a whole.

The scale of a fish may be described as a little thin transparent plate, and upon this plate is engraved, so to speak, the whole history of the fish—more particularly of the salmon and trout. These scales are embedded in little pockets of the skin of the fish—so far as regards two-thirds of the scale—the remaining one-third being the exposed portion, which is what you see on the fishmonger's slab. The hidden portion is called the Anterior, and the exposed portion the Posterior part of the scale.

The use of these scales is undoubtedly to preserve the body of the fish from the attacks of the numerous parasites which infest salt water, and in order to do this effectually, and to make what a workman employed on slating the roof of your house would call "a tight job," these scales overlap one another—just like the tiles of a house. Now, underneath the scale of a salmon,

there lies that beautiful silvery membrane, or skin, which makes its appearance so attractive as it is exposed on the slab. This silvery membrane has the power of reflection, as a looking-glass, which is very valuable to the fish as it lies on the bottom of a pool in the river, for it reflects the colour of the surroundings, such as rocks, etc., and so disguises the appearance of the fish from its enemies. Speaking from my own experience, it is by no means easy to detect a salmon lying at the bottom of a river, unless it turns its silvery side up towards the rays of light.

Now in order to understand the history of the fish as stamped, so to speak, upon its scale, it is necessary that the student should have some knowledge of the habits of that fish, for in the case of the salmon, which passes part of its life in fresh water and part in salt water, these changes of condition are so well marked on the scale, as to enable anyone who has had some little experience in the study of fish-scales, to tell with accuracy how many years the fish has passed in fresh, and how many years it has passed in salt water—how many winters it has passed in the sea—and, more important than all, whether it has spawned and how many times.

For the benefit of those who have no intimate ideas as to the average life and habits of a salmon let me briefly give a short description.

Salmon, as most people know, are anadromous. They approach our coasts from the sea at certain times of the year to go up our rivers for the purpose of propagating their species, and it is a remarkable thing that whereas the salmon has to seek the fresh water for depositing and hatching its ova, for the reason that salt water would destroy the vitality of the eggs of this fish, so the ordinary freshwater eel, found in our rivers, is obliged to go down to the sea to deposit its spawn in the deepest portions of the ocean.

To return to salmon, the ova are deposited in the beds of rivers where water flows with rapidity, and these spawning beds are called "redds." After some weeks, hatching commences, and for a period of two years the young fish so hatched remain in the fresh water of the river, at the end of which term they are called "smolts." This portion of the fish's life is well marked upon the scales.

At the end of the two years the smolt by natural instinct proceeds down the estuary of the river, and goes straight out to sea. This is called the migration of the smolt, and by experiments on the River Tay it is found that these smolts congregate like a flock of sheep, and make their migration to salt water in big shoals. Some return the following year, in most cases to the river where they were hatched. Others come back in the second year after migration, whilst others remain in the sea for a still further period, until the spawning instinct compels them to visit our shores and ascend our rivers for the purpose of propagation.

Here it may be well to remind ourselves that it is for the one purpose of keeping up their race, that salmon come to our shores at all, and we are apt to consider that we know all about the life of a salmon from these periodical visits. The question has often been asked, "How long do salmon live?" It is quite impossible to answer this question with certainty, inasmuch as we only know the salmon during its fertile days. What becomes of it after the days of its fertility are exhausted—no one knows. It may still exist in the sea for many years after leaving our shores, and grow to much larger dimensions than we are accustomed to; so that because we only know it, at the most, as an eight-year-old fish, there is no reason why it should not exceed this limit by a number of years. Now all these different stages in a salmon's life are well marked on the scale of a fish in the following manner:—

With the aid of a good lens you will observe first of all a centre, which we will call the centre of growth, formed, let me say, in the very early stages of the fish's life. Round this centre are formed lines of growth—just according to the growth of the fish. Mr. Malloch, in his book on the Salmon, says that it makes sixteen of these lines of growth in the course of twelve months; just as a tree makes one ring for each year of growth, so the salmon makes sixteen. Now, with all respect for Mr. Malloch's assertion, I am inclined to differ from him. My experience teaches me that a salmon, during the first year of its sojourn in the salt water, makes twenty lines of growth and more, owing to voracious feeding, and afterwards these lines diminish in number as the fish grows older. It is the same with sea-fish. These lines of growth in the river life of the fish appear to be very close together for, say, a period of two years—when food is scarce in the river—and consequently the growth is slow, but immediately the smolt migrates to salt water, there is a very rapid change, owing to the abundance of food, and the lines are much wider apart. This condition of things obtains during the first summer in the sea, but when the water gets colder in winter, and food becomes scarce, the growth becomes stunted, and the lines of growth appear like a dark band on the scale, in consequence of being much closer together, and this is called the winter band or hibernation mark, so that the summer lines of growth and this winter band complete one year of the fish's life. This, then, is the way by which you can calculate the age of a salmon.

This process is what goes on in the sea, but a very different thing happens when the fish returns to the fresh water of the river. The chief run of salmon from the sea occurs in the early spring, and at this time the finest fish for the table are caught in the nets along the coast and at the mouths of some of our finest rivers. These salmon arrive in the very finest stage of perfection. They enter our rivers, bound for the spawning beds, which means a journey of many miles before they reach

them. Salmon deteriorate in condition the moment they leave the salt water, and it is difficult to believe it, but nevertheless it is a fact, that these fish undergo a long fast of ten or even twelve months before they are sufficiently matured to spawn. This means that, in the course of time, the body shrinks and becomes very much emaciated and discoloured, so much so that it is not easy to recognise the bright silvery-looking fish which entered the river some months before. In consequence of this great change in the fish owing to the prolonged fast the outer coating of the scales becomes too large for the body, and the edge of the scale gets disintegrated and ragged—much of it disappears altogether.

One reason why this takes place is that, in consequence of the low condition of the fish, it is unable to nourish the outer edge of the scale. Just as the leaf of a tree begins to wither at its outer edge when autumn comes on, and the sap of the tree descends, so the outer edge of the scale of a fish is affected when the body is unable to provide nourishment for it.

This, then, is the first step towards the spawning period of a fish's life, and you will observe from the slides how interesting this is in the study of fish-scales.

After the salmon spawns, it returns in course of time to the sea, where it quickly recovers its condition, but it still has this injured portion of the scale. The wound, with voracious feeding, soon heals up, and the scale recovers its normal condition, but the healed-up wound is still to be seen on the scale—a veritable cicatrix or scar—and this is the clue to be found which determines the important fact as to whether a salmon has spawned or not. Before scale examination gave us some information regarding the life of a salmon it was commonly supposed that salmon spawned every year, but research has upset that idea, the real fact being that few salmon spawn more than once, a very few twice, and it is a most rare thing to find a scale showing three spawning marks, though I have in my possession a slide which shows three spawning marks, and a disintregrated edge to the scale which proves that this fish had spawned four times, as it was caught as a kelt returning to the sea after its fourth spawning. This fish was caught in the experimental nets at the mouth of the River Add, Argyllshire. It was marked, and if it returns again to this river, which it may do next summer, it should bear on its scales no less than four spawning marks; and, so far as my experience goes, such a scale has never been found up to this date. It would be a most valuable addition to any student's collection of fish-scales.

Such, then, in a condensed form, is the history of a salmon as told us by a study of its scale.

Sea-Fish.

The same characteristics of periodic growth are marked on the scales of many of the sea fish.

This is very apparent on many of the Gadidæ genus—such as the pollack, haddock, whiting, and others of the same race.

The Pleuronectidæ also show signs of the same periodic growth, but not quite so markedly as those of the Gadidæ. One of the most interesting points to be noticed in the Pleuronectidæ, or fish swimming on their sides, is the strange metamorphosis from a round to a flat fish. They are all hatched as round fish, but after six weeks from their birth become swimmers on their side, and in the case of soles, plaice, dabs, etc., the left eye moves over to the right side, the fish expands in breadth, and tilts over on its side, gradually getting deeper in the water till about the fortieth day after hatching it matures into a flatfish, assumes a brown colour on its top side and white underneath, and is then about three inches long.

The white colour on the under side is accounted for in this way. Mr. Cunningham, whose valuable book on the Sole is so well known, conducted experiments to show that the white under side was entirely owing to the shutting off, so to speak, of the rays of light from that portion of the fish. He arranged a series of mirrors so as to reflect light underneath a tank at the Laboratory at Plymouth, where some plaice were confined, and caused light to be reflected to the under side of the fish, and so successful was the experiment that he caused the under side to become the same colour as the upper side, proving that the absence of rays of light to that portion of the fish was the undoubted cause of the white appearance. This same experiment is brought home to us by tying up a lettuce to bleach the interior, or by putting bulbs in a cupboard where light is shut off, and the growth will become more or less bleached.

Flatfish also have the power of assuming the coloration of the sand or bed on which they rest. This is caused by a series of pigmentary cells on the brown side having the power of exuding the right colour of the sand-bed, and thus the fish becomes practically invisible to its enemies. This is called protective colouring.

The scales of sea-fish are divided into two classes—cycloid, or round-edged, and ctenoid, or comb-like—owing to the spines on the exposed portions of the scales resembling the teeth of a comb. These spikes are readily felt in passing the hand over the surface of a sole, a dab, and other fish.

Otoliths.

Every fish has two little stone-like substances in its head, which are called otoliths, or ear-stones, and by means of which fish are sensible to the vibrations of the water, much in the same way as human beings are sensible to the vibrations of the air, which we call hearing. These otoliths are to be found in two little cells at the back of the brain, and attached to it by means of very fine ligaments, so that they are in communication with the brain, and are similarly connected with the spinal column. They vary in size to a great extent—for instance, the otolith of a 15lb. cod weighs

160 times heavier than that of a salmon of the same weight, and about 13 times heavier than a halibut's otolith. The reason for the great disparity in weight between the Otolith of a Cod and that of a Salmon of the same weight, arises, in my opinion, from the fact that a Cod is a deep water fish and the Salmon is supposed to be a surface water fish—the former would therefore require a sounding board, so to speak, of much larger dimensions for such a density of water in comparison to the latter.

The haddock seems to have the heaviest otolith for its size in all the Gadidæ tribe. The otolith of a plaice is a very beautiful object, showing a series of light and dark rings, by which the age of a plaice is easily ascertained, but the otoliths of all the Gadidæ tribe are too opaque to be of the slightest use for this purpose.

ADDENDUM.

New Zealand Trout.

For fifty years or more various attempts have been made at considerable expense to introduce the *Salmo Salar* into New Zealand Waters from this country. Up to the present, failure after failure has to be recorded, and the problem remains unsolved.

Nothing can go better with the experiment up to a certain point. The hatching and the early growth of the fish are a great success, but when the smolts are ready for migrating to the sea, nothing could be worse. They migrate, but are never seen nor heard of afterwards. The reason for this failure can only be a matter for conjecture.

The late Mr. Sclater, who was Secretary for the Zoological Society, was much interested in the matter, and knowing that I was going to New Zealand in the 'seventies, asked me to write him a paper for his Society, describing what I saw, and the probable reason for the failure. I had every opportunity when I was there to go fully into details, and I came to the conclusion that there were two obstacles to success. In the first place the ocean round the coast of New Zealand is one of deep water and, as a consequence, the food of the salmon is wanting. The shallow waters which surround the coast of Great Britain, on the other hand, abound with fish, and thus these waters form a vast spawning bed. The deepness of the ocean is not the home of herring and crustaceans, such as the salmon has been accustomed to, and it comes to this, that a fish of surface habits is being introduced to a habitat, which is totally inconsistent with its natural state.

Another cause of failure may be the existence of large deep water fish, which prey upon the young smolts at the mouths of the rivers.

This then, and the want of their natural food may be the two chief causes of the failure to introduce the *Salmo Salar* into New Zealand Waters. In our home waters we have no monsters

of the deep to contend with. The smolts go down to the sea in their thousands when only two years old, and return in the following years fine, strong, healthy fish in the pink of condition—a valuable article of food for the nation.

But when we come to Trout there is a very different tale to tell. The introduction of Brown Trout and Rainbow Trout has been one vast success. Nowhere in the world is there better Trout fishing than in New Zealand. An examination of the scales of the majority of these New Zealand Trout show that they are assuming the habits of the salmon, inasmuch as spawning marks are well defined on the scale—similar to the Salmon—whereas their ancestors in this country show nothing of the kind. I have examined a good many Trout scales during the past few years, but I have never yet come across a spawning mark defined on any one of them. This seems to show that the Trout in New Zealand take a longer time in their spawning arrangements, and as a consequence there is some considerable wastage of the body in the process, as in the Salmon of this country, whereas the Trout of our Islands occupy a much shorter time, and there is but little waste in the fish, so there is no spawning mark. I am told also that of late years the Brown Trout of the Middle (or South) Island migrate to the sea when of considerable size—returning to the rivers as bright as any Salmon.

These two characteristics of the New Zealand Trout, viz., the appearance of the spawning mark on the scale, and the migration of the adults to the sea (both of them common to the Salmon), surely point to the probable evolution of a fish in years to come, which may accustom itself to the new surroundings, and which may earn the title of "*Salmo Novæ Zealandiæ.*"

PLATES.

NOTE.

The size of the scales as shown on the Plates is no indication of their real size. The magnification is specified on each Plate.

Plate IV., Figure 1, illustrates the smolt stage of a Salmon before its first migration to the sea.

Plate IV., Figure 2, shows the Grilse stage, the fish having passed one winter in the sea.

Plate V., Figures 1 and 2, show scales from Maiden Fish at various ages, returning to the fresh water for the purpose of spawning for the first time.

Plate VI., Figures 1 and 2, show the scales of Fish after spawning. Fish in this stage are called Kelts.

Plates VII., Figures 1 and 2, are scales of Salmon which have spawned and recovered in the sea, and are returning to the river to spawn again.

Plate VIII. is the scale of a Fish which has spawned four times, caught when descending the river after its fourth spawning.

Plate IX., Figure 1, is the scale of a large Irish Lake Trout.

Plate IX., Figure 2, is the scale of a Rainbow Trout from New Zealand, showing a spawning mark.

Plate X., Figure 1. Scale of a Dab with Ctenoid edge.

Plate X., Figure 2. Scale of a Haddock, showing Cycloid edge.

Plate XI., Figure 1. Otoliths of a Plaice.

Plate XI., Figure 2, shows the difference in size between the Otoliths of a Cod and of a Salmon.

EXPLANATION OF LETTERING ON THE PLATES.

C.—Centre of growth.
R.L.—River Life.
W.1.—First Winter in sea.
W.2.—Second Winter in sea.
W.3.—Third Winter in sea.
S.M.—Spawning Mark.

The Chalybeate Spas (so called) of the Bournemouth Cliffs.

By G. Brownen, F.C.S.

Read before the Physical Section, April 10th, 1913.

THE subject now brought before our Section and the Bournemouth Natural Science Society is one of great local interest and closely connected with economic and scientific problems, such as the disintegration of local rocks, crumbling cliffs, and moving foreshores. Our purpose in this paper is a physical or chemical one—of course by chalybeate spas we mean such springs that issue from the soil containing iron derived from the strata either shallow or deep. Such ferruginous waters may contain iron in one of three conditions—1 Ferrous, 2 Ferric, or 3 in a more complex union with other salines. The Bournemouth cliff spas seem to begin as class 1 quickly pass into 2 or 3 and deposit and disappear, indicating that the springs are not true permanent spas at all. Deep or shallow wells sunk within the Bournemouth area have not as a rule proved of chalybeate character, but when we approach the coast lines subject to marine influences at various points between Durley Chine and Hengistbury, cliff springs containing notable proportions of iron in solution have been found, and it is with this fact that we are now dealing.

Our personal investigations of these peculiar waters date back to 1877 and were intermittent, but in the '80's we supplied Dr. H. Dobell with some notes for his work on "Bournemouth and its surroundings" (9. v.). Our notes and recollections of past investigations begin near Durley Chine on the western side of Bournemouth. Near the entrance to this ravine was one of these springs with a perceptible styptic taste—it was found to contain iron in Ferrous and Ferric conditions, and the stains of Ferric Hydrate marked the water course towards the shore. At or somewhere near the present zig-zag on the cliff lines was

another spring—our notes upon it bear date 1886, and the results may be stated as follows per imperial gallon:—

Ferrous Sulphate	grains	7.2
Magnesium Chloride	,,	1.0
Sodium Chloride	,,	19.3
Sodium Sulphate	,,	11.4
Ferric Hydrate, etc.	,,	3.6
Organic Matters	,,	4.4
Total salines per gallon	,,	46.9

By the courtesy of Mr. Cooper, the Sanitary Inspector of Bournemouth, we have been permitted to quote from a report of Mr. Cripps, the Borough Analyst, an analysis of a sample of water taken at or near this spot in June, 1906, or about 20 years later. Mr. Cripps' figures are:—

Total Solids per gallon	grains	48.0
Sulphuric Acid (combined)	,,	6.4
Alkalinity to methyl orange as $CaCO_3$		0.8

As concordant results these indications point to the reactions of rainfall and sea salines upon the ferruginous constituents in the soil.

Near the southern entrance to Boscombe Gardens was another ferruginous spring; we have a vivid remembrance of a well encrusted bowl attached to a post in the shelter provided by the Bournemouth Commissioners and hung up in this circular thatched shelter was an analysis by Dr. Hassall, of London, recommending its use. Alas! that analysis has left the shelter, and so also apparently has the Doctor's report for, although some of the Borough officials have kindly rummaged their old documents not a trace of it can be found! Fortunately an old Guide Book of Messrs. Hankinson's has come to hand and in it, on page 35, we find this extract from the report—the water is "mildly chalybeate," . . . "It is remarkable for its freedom from carbonate and sulphate of lime, to which circumstance its extreme and highly desirable softness is due. It is particularly free from oxydisable organic matter, and is a water of great purity. Lastly, when aerated, it forms a beverage of a very agreeable flavour, resembling the true seltzer and which may be used with advantage at dinner." The spring rose on the estate of Sir H. Drummond Wolff, M.P., the water was bottled by Messrs. Briant & Co., but these are now no more in Bournemouth, and now rumour states that the chalybeate spring has disappeared into the Boscombe sewer! We took samples of this Boscombe Spa water in August, 1878, we found it slightly turbid, but preferred *not* to use the

ladle, and, after our return to London, submitted it to analysis with these results—

Ferrous Sulphate	grains	3.8
Aluminium Sulphate	,,	0.8
Magnesium Chloride	,,	0.5
Sodium Chloride	,,	27.5
Sodium Sulphate	,,	9.2
Ferric Hydrate and Silica	,,	1.1
Nitrates	,,	a trace
Albuminoid Ammonia	,,	0.2
Organic Matter	,,	6.6
Total Solids	per gallon	49.7

We should like to compare these results with Dr. Hassall's, but the only comparison we have been able to make is, again, by the courtesy of the Borough authorities with one made by Mr. Tanner, the Borough Bacteriologist, dated 21st June, 1912—this sample was marked as " East of Boscombe Pier " and cannot be identical with the lost " beverage." Mr. Tanner's report defines the spring as "brackish" and "unsuitable for drinking purposes." His figures given are: "Physical characters, slightly turbid and odourless. Chlorine, 22.0 parts per 100,000; Free Ammonia, nil; Albuminoid Ammonia, 0.012; and Nitrates, 0.7 part per 100,000, and a faint trace of Nitrite." This report practically makes the Chloride salines a little more and the albuminoid matters a little less than given in our older report, but we must remember not only the time element but that the springs were on opposite slopes of the Boscombe Chine. Further east, on the Southbourne cliffs, were other ferruginous waters issuing from the cliffs. One of these in the summer of 1882 was in the form of an overflowing shallow well, and a sample taken below its undisturbed surface was found as a clear pale straw yellow coloured, sour and styptic fluid. Upon analysis the composition of this water was found so peculiar that we prefer to state its constituents as found, rather than group them as probable salines. These were:

Sulphuric Acid	grains	128.7	
Iron (Ferrum)	,,	46.4	Ferrous 18. Ferric 28.
Sodium, as Soda Salts	,,	29.5	
Calcium and Magnesium	,,	25.2	
Chlorine, as Chlorides	,,	15.2	
Aluminium, as salines	,,	5.7	
Nitrate	,,	1.3	
Organic Matter	,,	6.4	
Silica and insolubles	,,	8.5	
Total Solids	per gallon	266.9	

A year or two later Mr. Kingzett examined and reported upon a similar water derived from this neighbourhood (see "Bournemouth," by Dr. H. Dobell, p. 227). Mr. Kingzett describes the water as strongly chalybeate and possibly useful medicinally—its total salines were then 273.50 grains per gallon.

These examinations, unfortunately, are not so complete as continuous observation and analysis might make them, yet they will fairly account for the origin and peculiar nature of the waters. Iron is not in solution as Carbonate, that is to say— it is not dissolved from soft ores by the Carbonic Acid of the soil. The solvent radicals were mainly Hydrochloric and Sulphuric Acids, and the chief bases in union were Soda, Lime, and Magnesia. The springs rise from no great depth, and there is no rocky hinterland that would explain their production at the coast line. Two elements must play important parts in the production of these ferruginous cliff springs:—I. Rainfall or soft water containing besides dust minute proportions of Ammonia, perhaps as Nitrate and Sulphate, and II. Sea Water, which contains Sodium, Magnesium, and Calcium, salts of Chlorine and Sulphuric Acid like the springs we have examined. Not only is the storm spray driven upon our cliffs, but the capillarity of our sands and gravels favour the reaction upon the ferruginous minerals in moist contact —one of these is Pyrites or Ferrous Sulphide, a combination of Iron and Sulphur—an ultimate oxidation of which gives the soluble Ferrous Sulphate. Irregular deposits of pyrites occur along our cliffs as geological deposits, but there exist also recent formations of such compounds in the black earth at the rootlets of plants—an outcome of plant life as its excreta. There are known microbial forms and enzymes which form similar products. Thus much for the production of modern as well as ancient pyrites or compounds of iron and sulphur. The soluble Ferrous Sulphate will form a loose combination with Sodium Sulphate or Chloride or even take up a little Aluminium that may happen to come in its way and so form a crude Alum, and later on, oozing out near limestone, leave a portion of its dissolved iron in exchange for lime. The orange colouration tells its own tale of substitution below the pipes issuing from our sea walls which conveys the land drainage to the sea.

These so-called chalybeate springs in our cliffs, intermittent and largely dependent upon storm and rainfall, were neither true nor reliable, and we only regret their loss because their composition and quantity were variable items which might be established by successive analyses. But there is another and vaster field of interesting research opened by these facts, viz.: Our cliffs or shore lines are being constantly etched, sapped and sectionalized by the solubility of some of its rock constituents, chiefly iron. The changes this element undergoes or promotes are amongst the most puzzling of natural phenomena. Its granular or crystalline texture and resistance troubles the metallurgist and engineer—its polarity,

attractive and repulsive, link it to the electric force—its oxidation, yielding crystalline and colloid forms, are bound up with the mysteries of life and death in plants and animals, there is even a known micro-organism which in aerobic conditions will precipitate iron from its solutions and, upon the other hand, under anaerobic conditions, will dehydrate and mass iron precipitates as artificial bogochre. The ferruginous springs of our Bournemouth cliffs we have examined are like the handwriting on the wall, telling of Nature incessantly but obscurely at work along our foreshores, using rainfall and sea water to remodel the land in contact. Can anything be done to direct or modify these slow changes? Well, that is a matter for the engineer, and in his hands the chemist leaves it.

Flowers in Stone as applied to Church Architecture.

By Miss Ida M. Roper, f.l.s.

Delivered as a General Lecture at Trinity Hall, April 26th, 1913.

THE architecture of a people is an important part of their history, and the condition of the art at different periods tells much about the influences at work amongst them, some making for a higher civilisation and others thrown back to lower tastes. In our churches we have many examples to show the feelings of the skilled carvers of the time, and a study especially of the ornaments that were added to the main building help to make us familiar with their surroundings.

Apart from mouldings and figures the ornamentation to be obtained by foliage was early recognised, in fact as soon as buildings of stone were erected for important public purposes. Going back to the period of the sculptured temples of Egypt and Assyria there survive amongst the ruins representations of trees and vines used in decorative scenes, while in the Bible the reference to the ornaments, shaped after flowers and fruits, are too numerous to detail. Amongst the larger plants, we know that about the walls and doors of Solomon's Temple were carvings of the Palm, with rows of Pomegranates on the capitals.* The Acanthus leaves crowning the columns in Greek buildings of the Corinthian Order are familiar to all, and these, with some leaves of water plants were copied by the Romans nearly as beautifully,

* I. Kings vi., 29, and vii., 20.

until the art of carving was overlooked in the Dark Ages.

In England the few Anglo-Saxon Churches remaining show no ornaments of foliage, and the crosses no more than a rough outline of grapes and tendrils. The Norman buildings, however, of the many Religious Orders were decorated in parts by carvings inspired by examples from the vegetable kingdom.

This became marked at the close of the Norman period, from A.D. 1175 to A.D. 1200, when designs based on Roman models were common on capitals. Even at that early date the carvers or masons living in England were influenced by their surroundings, and here and there on capital or corbel the young fronds of the bracken fern can be recognised as they uncurl in the early spring, and the large arrow-headed leaves of the cuckoo-pint, or wild arum, as carved in the spandrels of the triforium of Wells Cathedral.

It belongs rather to the architect to follow the changing style from A.D. 1200 to A.D. 1275, the century in which foliage and sometimes flowers were freely used for ornamentation in our Cathedrals and Churches, but in nearly all of them the marked characteristic of the period is the conventional, rather than the naturalistic treatment of the plants used as models. Although the foliage was thus altered in passing through the hands and mental vision of the masons it is possible to easily recognise from their distinctive but conventionalised shapes the clusters of rounded leaves inspired by the campanula (the blue bell of Scotland), the common plantain of our gardens and the trefoil. The vine leaf, of course, is twisted over capital and boss, carrying on its symbolical meaning from the time of the Early Fathers, and another leaf constantly met with is that of the Holy Herb, now known to us as the Yellow Avens or Herb Bennet.

For many centuries this plant was looked upon by the monks and herbalists as a potent plant to protect human beings from the influence of evil spirits, and to cure their bodies of many ills, earning thereby the name of Herba Benedicta. The small leaves in Nature are deeply cut into three rounded lobes, but in the conventional carving they are shown nearly separated into three leaflets. It can be seen amongst the fancy sculptures decorating the arches and columns of an arcade in the Elder Lady Chapel of Bristol Cathedral. A three-leaved decoration was much favoured in all religious buildings in the South of England at this period, because the three lobes were suggested by, or emblematic of the Holy Trinity.

The only flower that seems to have been used at this period is the Rose, which was early associated with Christ the Saviour, and became so common in English buildings as an emblem of the kingly power of the Tudor Sovereigns. The south doorway of

Iffley Church near Oxford, dating from the beginning of the 13th century, shows a good example of its use in the moulding.

When it comes to considering the general application of flowers and foliage as ornaments for the various parts of the church buildings it has to be remembered that, almost without exception, they were placed there solely for decorative purposes and not as symbols, and hence it follows that an intimate connection existed between the plants and the styles of architecture to which they were applied. When decorative architecture flourished flowers were studied and copied for the effects produced, and when at the end of the 14th century the Perpendicular style was in favour the foliage ornament was largely abandoned and the plain deep cut mouldings took its place.

The reason why such a close association of the similar ornaments existed in buildings in different parts of the country is answered by recalling that at the period now under consideration there were no architects such as are recognised at the present day, whose art is occupied in planning, making drawings and superintending. The work was in those days carried on by officers often called "masters of masonry," who not only designed the building and its decoration, but carved these with their own hands, helped no doubt by other craftsmen that put into rough shape the ideas of the master.

It seems certain that such workers were closely bound together in schools of carving, which flourished where suitable stone was found, such as at Ham Hill by Yeovil, Doulting by Wells, and the Isle of Purbeck in Dorset. Each monastery probably had also a permanent staff of workmen attached to it, and, by some means not clearly known, the bands of workmen were in touch with each other to make known the designs and to keep up a uniformity of style in the ornament. Only in such a way can the use of the similar foliage and flowers be accounted for at the same limited periods in many different parts of England.

When regarded from a botanist's point of view the leaves of those plants already named—the campanula, plantain, trefoil, and herb bennet—that were used at this early period, are found to be of species with small leaves and a well marked stalk and central rib. These two characteristics of the leaves treated in a conventional manner rendered them specially suitable for the designs of the carver, who desired to decorate the capitals in such a way that the leaves appeared to be growing around them, rather than placed there to cover a blank space, and the knowledge of how to adapt the plants to this style was still on trial.

Having experimented to produce these small conventional ornaments the craftsman passed on to more complicated productions, which show from the ease with which the different leaves

and flowers can be recognised that he had gone more and more to Nature herself—gone in fact into the fields and woods and copied in stone the common plants he found growing at his feet.

To continue the architectural aspect of the subject a little further, a change came again after this naturalistic period and the mason showed signs of returning to conventionalised designs of the natural plants, so that the botanist finds the number of flowers and leaves grow more scarce, and the source of the craftman's inspiration more difficult to trace.

The art of the period from A.D. 1350 onwards sought to twist the conventional foliage into regular or geometrical patterns and to ignore the natural growth of branch and stem.

By the beginning of the 15th century the carved forms were largely abandoned, and were replaced on capital and arch by mouldings more or less deeply cut.

It is thus the 14th century, and especially the first half of it, that possesses most interest to show the development of "flowers in stone," a period poetically described by a recent writer as "the moment when carving burst into full leaf—the June of architecture—before there was a sign of the crumpling which evidenced approaching decay."* The word "flowers," however, must not be used with too narrow a meaning, but rather as including several portions of the plant.

At the beginning of the Naturalistic period the Cathedrals of Wells and Bristol and many other buildings excel in floral sculpture. Of the most beautiful examples reference need only be made to the shrine of St. Frideswide in Christ Church Cathedral, Oxford, and the vaulting of Exeter Cathedral with its many hundred bosses. In the shrine erected about A.D. 1289 there are no less than twelve different plants represented in the carvings of the spandrels and in the Exeter bosses the number of floral decorations is very large by repetition. From these two sources it is possible to realise how completely the Naturalistic School in its short reign of forty years was inspired by the flora of the fields and woods, and the carvings clearly show that the subjects were derived from trees, shrubs and herbaceous plants reproduced in genuine naturalistic form and with great decorative effect.

Beginning with trees the Oak is the most frequent. The artist seems to have taken for his model in many examples the true English Oak with its short, oblong leaves. Sometimes the leaves are arranged singly in a running but formal border; or a similar use of the plant shows sprigs of acorns alternating with the leaves and appearing again amidst the foliage of the finial. And yet another example depicts the acorn in some cases to have fallen away leaving only the empty cup amongst the clusters of fruit. At other times the artist was inspired by the Turkey Oak, which is common along all the Mediterranean coasts, and is distinguished from the British by the long, narrow and much serrated

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* Prof. W. R. Lethaby: "How Exeter Cathedral was built,"

form of its leaves. Bosses in the vaulting of Bristol Cathedral show both kinds of leafage. In the same Cathedral there is a stellated recess dividing the Berkeley Chapel from the choir the design of which is unusual, because carved on the oak leaves are clearly shown examples of a species of oak-gall, placed like peas on the leaf veins, and known in modern times to be caused by the puncture of a small fly of the Cynips tribe, which deposits its eggs in the substance of the leaf. (Fig. 1.) It shows how carefully Nature was observed by these early craftsmen and how they strove to carve true representations of the plants they knew, begrudging no expenditure of thought or time in adding such interesting details as these small round excrescences which are familiar objects on the foliage of oaks in those woods where the gall insect abounds.

Another tree represented constantly is the Maple, with its five lobed leaves and winged fruit. Its application in stone was a common ornament of bosses and corbels in many buildings of this period, and a century later was a close competitor of the oak and vine. It is to be seen in Ely Lady Chapel, on the altar at Beverley, and in Lynn Parish Church, whilst in Bristol Cathedral it forms a handsome border round a recess built to receive one of the Berkeley knights, and the finials show an artistic treatment of the same plant.

In one of the spandrels of the shrine of St. Frideswide in Christ Church Cathedral, Oxford, the maple with its fruit forms a deep frame round a female mask. This fruit, in scientific language the samara, consists of two nuts placed side by side with two wings spreading horizontally, so as to form together one straight line, and by this formation the maple is easily distinguished from the fruit of the ash and sycamore.

The carving of the maple on the Berkeley recess has led to an unfortunate error in the many published descriptions of the plants used in ecclesiastical sculpture of the 14th century. The statement is made that Bristol Cathedral holds the unique position of showing the Mistletoe amongst its carved stonework. This is a mistake and had its origin in the casual observations of a passer-by, who, noting the modern restoration of the maple fruit on the lower end of the arch, where the original carving had become worn away, thought he recognised in it a representation of the berries and angular leafage of the Mistletoe, the symbol of the Druids in their religious observances. Had he looked more closely he would have detected that the maple fruits and foliage higher up the arch were springing from the same stem, and that the lower portion was bad modern workmanship in which the mason ignorant of his subject had cut new fruits with the wings lying at an angle to each other, instead of in a straight line, and would thus have avoided an error which has been copied and repeated ever since without any truth.

The Beech is another forest tree that inspired the early carver. Its thick twisted stems and leaves are rendered as early as the year A.D. 1301 amongst the hundreds of bosses that adorn the lofty vaultings of Exeter Cathedral and it probably owes its introduction in contemporary roofs on account of the artistic treatment possible with the unfolding of its deeply puckered and slightly serrated leaves, and of its connection with the use of beechen boards on which were written the early Gospel extracts or books.

The Apple is another tree that lends its form to the adornment of boss or finial, the rounded fruit being often introduced amongst the foliage.

The Ivy, too, with clusters of berries finds a place in Winchester Lady Chapel, in Bristol, and in a large corbel at Exeter, where the beautifully sculptured egg-shaped and pointed leaves show that the design was taken from the Tree Ivy and not from the leaves spreading on the ground.

The Hawthorn is likewise repeatedly represented. It forms the motive of one of the Bristol Cathedral stellated recesses, and in the central finial there is a cluster of the well-known haws peeping out through the deep lobes of the leaves.

Exeter Cathedral has a large boss of Hawthorn, into which is introduced a favourite 14th century theme, viz., birds, apparently thrushes, busily feeding on the berries. The same subject appears in the central finial of a lofty tomb recess in Tewkesbury Abbey about A.D. 1340, but in this case the birds are more like doves picking at the fruit. Birds pruning their feathers or gaily disporting together were frequently introduced in carving by the ancient sculptors, partly because of their appropriateness in foliage subjects and partly because of Christ's references to the "fowls of the air," and to the statement of the Psalmist that the trees were planted to be the home of the birds.

On the ancient capital of a pillar in the Lord Mayor's Chapel, Bristol, birds of no distinctive type are engaged in feeding amongst foliage of a conventional nature.

Passing on to the shrubs that inspired the artists, the Vine is the most frequent, appearing in all parts of the early buildings. Representations of it are to be found in the early sculptured monuments of Egypt and Assyria, while the Bible carries its history back into the days of Noah, who, we are told, "planted a vineyard." The Vine and its fruit became a recognised symbol of the Church in the early centuries of Christianity, while its broad and clearly veined leaves made it a suitable design for the skill of the workmen and its intertwining and climbing habit appealed to his requirements.

Although the knowledge of the Vine may have come to the artists from the South of Europe, it would have been well known in England, for the existence of forty vineyards is recorded in Doomsday Book. To this day many woods still bear the name of "The Vineyard."

Apart from the use of the Vine as an emblem of the Church it is easy to find carvings of it in most Cathedrals as a purely naturalistic decoration, and in some instances, with a tendency to the conventional, in which the surface of the leaves begins to show the curious bulbous undulations that became almost universal in the following century.

The stone canopy in the Presbytery of Winchester Cathedral is a good example of this conventional form of the Vine, which, although erected at an early date, is represented with the curious swelling in the centre of the leaf and thereby giving to the border a rich and elaborate effect of light and shade.

Bristol Cathedral has an interesting application of the Vine leaf in one of the bosses over the Berkeley tomb. It shows a life-size face of a woman in the veil head-dress and with an unduly wide mouth, from the corners of which spring the stalks of large vine leaves to form a circle round the head with a cluster of grapes on either side covering the ears. Such bosses formed of a central face wreathed in foliage were very common devices at this period and probably had their origin in the actor's dramatic mask used by the performers in the Miracle Plays. Such masks would be familiar objects to the craftsmen, who found in them a model for the grotesque. The large opening, left that the actor might speak his part clearly, lent itself when used in decorations to form the starting point of the surrounding foliage, and as these masks were often hung in vineyards in ancient times to frighten birds, this arrangement of the foliage may have been suggested by the tendrils of the vine actually finding their way through the mouth aperture. In this instance, however, the woman's head with the head-dress of the time is thought to be a portrait of the Lady Margaret Berkeley, buried in the tomb beneath in A.D. 1327.

Another instance of a mask being the main feature of ornamentation is the carving of a man's head at the base of a pillar. From the mouth issue two oak leaves, which encircle the face in place of hair, and help to give a grotesque appearance to the whole.

The Rose is one of the most frequent plants carved in stone-work, and in its first form was double, like the early Provence rose of the garden, the lineal ancestor of the homely cabbage rose of to-day. The numerous petals in its naturalistic form, however, soon gave way to the simpler and more easily designed single or dog rose, which, in its turn, became conventionalised into the well-known Tudor rose. It appears to be used as a purely decorative ornament, and to have probably come into use in the Norman period, because it was such a well-known and beloved flower in England and was suitable for the simple ornamentation then required. This is its purpose in Bristol Cathedral, where a formal row of single blossoms of the double rose are carved round the arch of a window in a very bold and effective style, alternating with the leaves arranged symmetrically in squares in the same large proportion.

Round a doorway in the same cathedral are two forms of ornament, which have led to much discussion in the past. Reference will, at present, be made only to the inner one, which is a row of fruits placed touching one another and showing only the top portions, in the centre being a raised and small opening from which radiate five incised lines, as if to suggest the splitting open of the outer covering. There is no round fruit or bud in Nature that agrees with these markings, but it may be safely considered that the common "hips," or fruit of the rose, were the source of the suggestion to the workman.

This seems more certain after observing three finials over another doorway in the cathedral of the same period, wherein one of them has groups of single rose flowers in gradated series, and the others apparently rows of fruits, similar in appearance to those referred to in the mouldings of the smaller doorway.

The Hazel is another shrub to supply material to the craftsman and as it is so frequently found in the hedge-row, a branch of it may well have been cut off from some neighbouring tree and then copied into stone to be placed within a sacred building. It is well represented by its outspread leaves and clusters of three and four nuts on the boss of the vaulting of the Berkeley tomb in Bristol Cathedral. This boss is the companion one to that showing the vine already mentioned. The stems of the fruiting branch issue from the mouth and curly beard of a man's mask, while the leaves and fruit spread out and surround the head. This is supposed to be a portrait of the Lord Berkeley, who lies buried beneath with his mother.

Coming to the herbaceous plants which find a place on the capitals, bosses and mouldings, there is the Yellow Water-lily, its thick cup-like blossoms standing up erect, being familiar objects in many of our streams and ponds.

We find it in bud lying on its large leaves on a capital in Bristol Cathedral.

The handsome White Water-lily finds a place also amongst the sculptured flowers in Bristol. Beautifully carved and true to Nature, the blossoms appear on the outside of the tower of St. Mary Redcliffe Church, placed singly in a row along the arcade moulding.

Another plant is the White Bryony, the hedge vine of old writers, and a familiar flower of the hedgerow.

It is shown in naturalistic style on one of the stellated recesses of Bristol, with the blossoms and clearly marked tendrils for climbing into the sunlight, and, again,it gracefully entwines a boss in the Berkeley Chapel, together with its small red berries. The form of its leaves with well marked veins, is very graceful, and this plant and the Meadow Buttercup were much in favour in the Decorated period of architecture.

Examples of the Buttercup are to be found in another of the recesses, where the arch is closely decorated with the leaves

and blossoms. (Fig. 2.) And, again, in a particularly large form on the wall of the sacristy, with, in some instances, snails depicted crawling over them.

The single blossoms of the Buttercup in the vaulting show, apparently, the greenish yellow sepals behind the brighter portion of the flowers.

One other herbaceous plant whose foliage inspired the artist is the Columbine, a well-known flower all over Europe, and one often mentioned by the older poets while describing floral customs long since discontinued.

The leaves sculptured on one of the spandrels of St. Fridiswide shrine at Oxford is probably almost the only representation of it in stone at this early date.

As already stated, the larger row of ornaments on the Berkeley door has been a source of doubt to many observers.

It has often been described as representing the fossil Ammonite, one kind of which is found in the neighbourhood of Bristol. It will be found, however, that a marked character of all the species of Ammonites is a series of bars at regular intervals across the coils, and these ornaments have no such bars.

The artist who made a water-colour sketch of the doorway in 1824 for the Braikenridge collection of local drawings, now preserved in the Bristol Art Gallery, evidently recognised the importance of the ornament and gave an enlarged drawing, which materially helps one to recognise in it the fruit of a small plant with yellow flowers of the clover tribe—Medicago or Medick.

Its trefoil-shaped leaves are often met with in carvings of the period, but in this instance the fruit only is chosen, which consists of a long pod coiled round like the spring of a watch, and having on its outer edge a narrow, crinkly border. All the medicagos that grow in England have these coiled fruits, but their fringe, or border, consists of prickles, and the pod is not so contracted between the seeds, but there is a common species of the Mediterranean, *Medicago orbicularis*, whose fruit closely corresponds with this carving and is undoubtedly the source of inspiration to the artist. He was a clever workman, and put great skill into the execution, and, as in the case of some of his other carvings, was not afraid of heroic size.

One of the two remaining ornaments of this period is the Four-leaved Flower composed of four simple leaves or petals arranged to form a square-shaped blossom. It seems to be a simple geometric figure suggested by the common floral arrangement of the large family of cruciform plants, and was easily adapted to be placed at regular intervals, or closely united in a hollow moulding, or for more general use as a cornice to form a light and graceful finish.

In this form it can be seen on the verge of a monumental slab. (Fig. 2.).

When these four-leaved ornaments were closely united in

several rows the stone-work was called diaper work, and was in special favour in the 14th century.

It took its name from Ypres, a town in Flanders noted for the production of cloth worked in square patterns. It was common on great festivals to hang the walls of the churches with tapestry, and this may have led to diaper work in stone.

The other ornament of this period is the Ballflower, characteristic of the West of England, and found chiefly in the counties of Gloucester and Hereford, where its use is very common in church architecture. In Gloucester Cathedral the aisle windows of the nave are studded with no less than 1,400 examples of the Ballflower in each window, and in Badgenorth Church, near Cheltenham, the hollow moulding of every window and doorway is profusely decorated with it.

Many examples are to be met with in Bristol Cathedral, notably round the arch of one of the stellated recesses. The origin of the Ballflower ornament has given rise to much speculation, and at present there is no satisfactory solution. The ornament is represented as a ball partially enclosed in a round cup or flower, which holds it by three wavy lobes. By some it is supposed to be the globe flower of the North of England, by others to be derived from a horse bell or a hawk's bell, and by others, again, to be the young bud of the pomegranate. The Ballflower, however, has a far better resemblance to the ripe fruit of the Juniper, and as flower or fruit should be apparently looked for as the motive, it is reasonable to think a fruit is its real origin. The Juniper is allied to the Scotch Fir, and is common on heaths and chalky hills throughout the South-east of England, as well as in Northern Europe. The use of the Juniper berries was well-known amongst the early herbalists, and the name is several times mentioned in the Bible, so that the artists in stone would have been acquainted with its peculiar structure, and may well have chosen it as their model.

After considering these many examples of flowering trees and shrubs it is possible to realise how completely the Naturalistic School in its short reign of forty years was inspired by the flora of the fields and woods. Other plants made use of, in addition to those already described, are found to be the pear tree at Evesham, the birch, the poplar at Exeter, the mallow and the greater celandine at Oxford. These plants were probably chosen and repeated by craftsmen, because some of them, such as the vine, oak, maple, bryony, and meadow buttercup have broadly shaped leaves with clearly marked veins to give their beauty to the arch, the finial, and the boss, while the rose, hawthorn, ivy and pear have smaller leaves, whose veins or folds lend themselves to produce an equally good effect in closer form. Only the very best artists in stone could run riot amongst the crowd of flowers and fruit, and such men were scarce to do the work with their own hands; the average workman, therefore, had to repeat the designs taught to him in the school of carving, and

study only those plants with prominent characteristics, and this is the explanation why the total seems to be limited in number to about twenty different species. The natural foliage was carved with the utmost patience and loving care, and, therefore, settled into a fairly uniform type. With that uniformity came monotony, and about the middle of the 14th century it was abandoned as being too troublesome, and conventionalised work took its place. When the building of churches started afresh, following on the great prosperity of the woollen trades, the foliage ornamentation in sculpture was of the conventional kind, with the leaves arranged horizontally on the capitals and in geometrical pattern on the bosses. The Church of St. Mary Redcliffe, Bristol, is a noble example of this period of ecclesiastical building. The vaulting of its aisles and choir contain an excellent series of examples, where every junction of every rib, in the many-ribbed vault, is completed by a carved keystone or boss. The plants of the previous century are used over and over again, but in addition it is possible to recognise the holly, fig, bay, hop, thistle, hardfern, dandelion, crinkly cabbage leaf, and sunflower.

A series of water-colour drawings of these bosses give an idea how the carvers sought to decorate the intersections with floral designs done in the workshops and then placed in position. Some of the plants depicted are the vine, the hardfern, the oak, the ivy, the bay in fruit, a conventional leaf often used in architecture, the dandelion, the rose-en-soleil—a badge of Henry VII (1487), therefore, one of the later bosses, holly with prickly leaves and well marked veins, hawthorn in blossom, conventional flower and fruit, single rose arranged geometrically on a branch, dandelion and maple leaves together.

A handsome tomb in St. Mark's, Bristol, is a good example of later foliage decoration and ornate ornament, in which the cornice is limited to a running pattern of the tendrils, leaves and fruit of the vine, the cresting of the Tudor flower, suggested by the strawberry leaf and the rose finishing off the screen work of the arch. Hundreds of such examples are to be seen in the stone monuments and wooden screens in the work of the parish churches of the 15th and 16th centuries, and a good deal of modern ecclesiastic carving is but a copy of the characteristic reign of naturalistic foliage.

In drawing to a close the consideration of "Flowers in Stone," it must be clear that, although the work of the craftsman at the different periods could be excellent, yet his best efforts are no more than a coarse resemblance of Nature's handiwork. The humblest weed that grows in the cranny of a wall has a beauty that no mason can emulate, and his most faithful reproductions must ever disappoint the true lover of Nature.

Godlingston Manor: Its History and Archæology.

By Mr. L. V. C. Homer, B.A., LL.B.

A Paper read during the visit of the Archæological and Photographical Sections of the Society to the place, August 9th, 1913.

THERE are one or two preliminary remarks I should like to make before dealing with the subject of my paper. I do not profess to be an Archæologist at all in the proper sense of the word, but I venture to think that the Archæologist properly so called, in looking at a building like this, often falls into the error of paying too much attention to its actual workmanship, and not enough to its history. In a case like this, where we have no record of the exact date of any part of the building, the correct method seems to me to be to study carefully the history, both of the district and of the place and its owners, and then to deduce from the information thus obtained, at what period the owners would be likely to build, taking all the circumstances into consideration.

Before dealing with the history and archæology of this old place, I will ask your attention for a few minutes, while I sketch very roughly the general history of the Isle of Purbeck, and particularly of Swanage, which will enable you to follow more easily my subsequent remarks.

The Isle of Purbeck, like that of Portland, is only styled an island by courtesy, and no one, so far as I am aware, has ever been able to explain satisfactorily the reason of its being so called.

From Saxon times till the middle of the 17th Century, the greater part of the Isle of Purbeck was a Royal Forest, Chase, or Warren, usually retained in the hands of the Crown, but occasionally granted to some powerful nobleman. In consequence of this, grants of land in the neighbourhood were, speaking generally, comparatively small in size, and this I think, accounts for the number of small Manor Houses in which the district abounds. Owing to the smallness of these manors, and the proximity of the Royal Castle of Corfe, the Manorial Courts were probably not as important here as in other parts of the country. Purbeck was formally declared to be a royal "Forest" by King John, and thus became subject to the harsh Forest Laws, and though it seems to have been disafforested in the following reign, it still remained to all intents and purposes a Royal Forest down to the middle of the 17th century. James I. was the last of our kings who hunted from Corfe Castle, and Forest Courts were held there in the years 1618 and 1625. Speaking of this subject the author of a Survey of the Western Counties, published in 1635, says:—

> "In this Island doth range many goodly deer, that are hedged in with a surer pale than wood; which, when they are

hunted, will adventure into the Sea and take salt soils, whereby they stand long and make brave sport, of which (having a fit opportunity, and a little time to cast away) I had some part much to my content."

Swanage is only once mentioned in the Saxon Chronicle, in connection with the disaster which overtook the Danish Fleet. According to one account, the Danish vessels were wrecked off Peveril Point while on their way from Wareham to Exeter, while another account says that the wreck took place after a sea fight with King Alfred's fleet.

Godlingston was not mentioned by name in Domesday Book. What at first led me to think so was this. Certain lands called Moulham, were granted by William the Conqueror to a certain Durand, on condition that he and his heirs should find a carpenter to keep the gutters and timbers in the King's Great Tower of Corfe in repair when required to do so. In the fifteenth century the heiress of the family of Durand married Robert Rempston, the Lord of Godlingston Manor, and the lands held under this peculiar tenure became parcel of the manor of Godlingston.

In the reign of Edward the Confessor, certain land, probably including Godlingston, was held by three thegns, but after the Norman Conquest, it passed into other hands, probably by confiscation. Godlingston, as I said just now, was not mentioned by name in Domesday Book, but as it was held in after ages of the Manor of Duntish in the Parish of Buckland Newton, it may possibly have been included in the Swanwic, which is described in Domesday as being held by the wife of Hugh Fitz-Grip. On the other hand, as Duntish is not specifically named in Domesday, it may have been included (and with it the land here at Godlingston) in the general survey of the extensive Manor of Buckland Newton, of which the Abbots of Glastonbury were the Chief Lords.

The family of Talbot was resident at Godlingston at a very early period, for we find that one Aluard Talbot held one Knight's fee here in the year 1166. The place remained in the hands of this family till the latter part of the reign of Edward III. when it passed to the Rempstons who became their heirs.

Now we come to the most interesting chapter in the history of the place. A certain Stephen Mathew claimed part of the property comprised in the Manor of Godlinston from Robert Rempston (the same Robert Rempston who married the heiress of the Durands) on the ground that he (Stephen Mathew) was the heir of Rempston's predecessors in title, the Talbots. A very detailed record was preserved of the claims of both parties by John Estoke, stepfather of Stephen Mathew. The document is referred to in the pages of Hutchins' "History of Dorset" as "The Godlingston Roll." It is in Latin, written on parchment and said to be in a fair state of preservation and its date is certainly not later than 1427, as Estoke appears to have died in that year. Hutchins

gives a close translation of the document, which is interesting, not only for its genealogical and topographical value, but for the light which it throws on the customs, habits and morals of the period to which it relates. The dispute was ultimately settled in 1443 by the purchase by Rempston of Mathew's claim to the property for £20.

On the extinction of the male line of Rempston, in the reign of Edward IV. the lands then forming the Manor of Godlingston, which, from a deed of 1450, seem to have been considerable and to have comprised lands at Ulwell, Studland, Herston, Worth, Corfe Mullen, and Sturminster Marshall, were divided between two co-heiresses, and the Godlingston Roll passed with the lands of one of these ladies to the Perceys and Mompessons and eventually came into the possession of the Serrels of Durnford on their purchase of the Estates which the Roll had accompanied. I do not know in whose possession the document now is, but hope to ascertain.

Godlingston itself passed through the other of these heiresses to the Carrants, and came eventually, though how it is not quite certain, to one, John Pole, and on his death in 1560, to his sister Mary, who married a member of the family of Wells, of Banbridge, Hants. In this family, who continued to profess the older Faith, the property remained for over a century, during which time it was on several occasions seized into the hands of the Crown, to meet the fines levied upon them for recusancy. In 1645 the place belonged to a Captain Henry Wells, who fought on the Royalist side during the Civil Wars, for we find that his property was sequestrated. In 1687 the property was sold by Henry Wells, Esq., to the Framptons, who sold it in 1765 to the Bankes family, who now own it, though no member of the family has, so far as I can ascertain, ever actually resided here.

I have dwelt at some length on the history of the place, as it is only in this way that we can make a shrewd guess at the age of the various parts of the building. As you will doubtless have observed, the house is long and low, and very plainly built of stone. Unfortunately some former occupiers, without much idea of the fitness of things, painted a good deal of the stonework round the windows, but it is now, I think, gradually reverting to its original colour. The entrance door is irregularly placed with reference to the windows, both on the ground floor and above. The arch of the door had a pair of featherings, but one of them, you will notice, has disappeared. In the parallel wall of the house there is another similar archway. This is practically opposite the entrance door. The upper story consists practically of attics. "There are the remains of three dormer windows," says Hutchins, "the gables of which have been taken down." Whether he had any authority for this statement, or whether it is merely guesswork, I really do not know, but in either case, he is, it seems to me, probably right. The house was probably at one time considerably larger than it is to-day, when we remember

that the owners, during the Middle Ages, were people of considerable local importance.

The most interesting feature of the place is the old tower, at the extreme western end of the building. The walls are extremely thick, and slope outwards at the base forming a batter. There is no original doorway on the basement floor, but one, which seems to be original, stands about four feet from the ground on the north side. This doorway is very plain, without mouldings of any sort. On the upper floor there is only one window facing south. Above this there are two similar windows. These have long ago been blocked up from the inside. As they are immediately under the eaves of the roof, it looks as if the tower was at one time considerably higher, and perhaps these windows were stopped up when the walls were cut down. All these windows have a notch cut in the stone, about the middle of each jamb. This notch was probably made for the use of some defender of the place using a cross-bow. So far as I am aware there is no record as to the exact age of this tower. It is certainly either Saxon or Norman. If the latter, then it was probably built by one of the Talbots. Personally, I am inclined to think that it is of Saxon origin, although I have heard that Mr. Pouncey, the Dorchester antiquarian, ascribes it to the thirteenth century. My reasons for thinking as I do are shortly these.

It was obviously built as a place of security and refuge, when the inhabitants of the adjoining house were in constant fear of raids from the sea. This could not have been the case after the Conquest, when the power of the Norsemen and the Danes had been broken by their crushing defeat at the hands of King Harold at Stamford Bridge, and by the Normans in the fen districts. Piracy here in the Isle of Purbeck would be hardly worth the risk during the twelfth, thirteenth and fourteenth centuries, when the country was in the main a Royal Chase, and Corfe, with its strong garrison, was so near. What our Saxon ancestors had generally to fear was not so much a regular invasion, as a raid of comparatively short duration, but fierce indeed while it lasted. The Norsemen loved not sieges. What the Saxon thegns who dwelt here did was probably this. On the appearance of the Vikings in superior force they got, with all the moveable property they could haul after them, into this Tower, and turned their live stock loose on the wide expanse of heath and hill, hoping to recapture them when the Vikings departed. Probably therefore this Tower goes back to the ninth or tenth century.

As to the rest of the House, it is difficult to say when it was built. Being so plain I hardly think that it can be Elizabethan, though its general aspect rather suggests the early Tudor style, especially when we remember that, during that period, the property belonged to a persecuted family, and was on several occasions seized temporarily by the Crown to meet the fines imposed for recusancy. As the owners of the place during the fifteenth century were men of considerable wealth, I should say

that the central portion of the house was built by them, while the eastern wing was probably added at a later date. The interior of the house possesses no real feature of remarkable interest, except that, in the drawing room, over the mantelpiece, there is some curious stonework, well worth inspection. In the first edition of his work Hutchins says there was a chapel there, which formed part of the mansion. All traces of this have now, however, entirely disappeared. As the Wells family were Romanists, it seems very likely to have been built by them, though it too, in common with the central portion of the house, may have owed its origin to the fifteenth century.

When the house was restored some sixty years ago, the old stone staircase which then led from the hall to the upper floor was taken down and a wooden one erected in its place. Lovers of things ancient will, I feel sure, join me in regretting that the old stone staircase no longer winds itself round the pillar which still stands and which once supported it.

Museum Collections of the Bournemouth Natural Science Society.

By Sir Daniel Morris, K.C.M.G., D.Sc., D.C.L.

The following notes contain a brief account of the Collections now in possession of the Society or likely to be shortly acquired by it. The formation of a Public Museum of Natural Science has already received attention. The Museums Act was adopted by the Borough Council in 1906, but no steps have since been taken to give practical effect to it. In the meantime the Society is making an effort to bring together and arrange collections acquired by it until they have attained such bulk and importance as will justify the erection of a building in which they could be effectively displayed. The primary aim would be to illustrate the progress of human knowledge and attainment, with special regard to objects of local significance and value.

Antiquarian Collection.

Mr. Brownen has kindly supplied the following information relative to some of the specimens presented by him:—All the specimens are strictly local, and some of them are of historic interest. The black glazed ware—similar to Upchurch, but quite distinct in type both from New Forest as well as Upchurch ware—seems to have been made by steeping the biscuit ware in a thin solution or emulsion of fine clay and iron pyrites and fired with a bituminous fuel—possibly our local Kimmeridge shale. It approaches the early Egyptian type, and our local manufacture may have been originally derived from the Levant.

The coin of Vespasian from our neighbourhood is not a solitary "find," and may doubtless be associated with the campaign of that General of Claudius against the Durotriges in A.D. 43-47, or else the later operations of Agricola, when that coinage was current. The small hoard of semi-fused Roman coins, whose condition must be assigned to a later date than the first of Gratian (A.D. 375) suggests the result of a Saxon raid not long before the Roman recall.

With reference to the English coins. It is interesting to note that during the reigns of Henry II. and Henry III. there were times when the lords were minors, and the manors in the administration of the Crown.

Edward I. bought the manor and other properties from Isabella de Fortibus outright in consequence of the death of his sister-in-law Aveline, who was Isabella's only daughter.

1.—Funerary Urn of the Bronze Age (on a bracket), presented by the late Dr. A. Thomas.

2.—The Hemsworth Villa Venus Pavement, a drawing to scale by Mr. Brumell (framed, in a case on stand).

3.—Relics of the Pokesdown and Southbourne Prehistoric Villages, presented by Mr. D. Chambers.

4.—Relics of Christchurch (Bolvelaunio) and district, presented by Mr. George Brownen, F.C.S., These are as follows:—

(1). A case of Prehistoric Funerary and Domestic Pottery, 18 fragments (Bolvelaunio).

(2). A case of fragments of New Forest Romano-British Pottery, 2 pieces (New Forest), with three typical amphora necks, 1 Celtic, 1 Greek, 1 Roman (Bolvelaunio).

(3). A small case of stone implements from Pokesdown, 6 pieces (Pokesdown).

(4). A small case of stone implements from Katterns Hill, 8 pieces (Katterns Hill).

(5). In small case, sling stones from base of Watch Mound, 3 pieces (Katterns Hill).

(6). Ten large worked stone weapons, sources named and dated (various).

(7). A case containing Coins of Vespasian, Galerius, and Constantine II., 4 coins (Bolvelaunio).

(8). A case of burnt and semi-fused Coins—the latest, Gratian, A.D. 375-383, 8 coins (Bolvelaunio).

(9). A case of English Coins, Henry (?), Henry II., Henry III., Edward I., 4 coins (Bolvelaunio).

Botanical Collection.

The Botanical Collection is still in course of being classified and mounted so as to afford means for students to identify their specimens and study the general character of the flora of the district.

Among the dried plants that have lately been presented are 285 (mounted and named) by Mr. R. V. Sherring, F.L.S.; and 825 by Mr. H. E. Swain. Other specimens are 9 Nipa fruits, presented by Sir Daniel Morris, K.C.M.G.; mounted sets of Marine Algae from Mount's Bay, presented by Mr. R. A. de Paiva; and from the Scilly Islands, by Mr. J. M. French. Various specimens of plants collected by Mr. James E. Liddiard in New Zealand and South Africa, and a collection of New Zealand ferns, presented by Mrs. Liddiard. Miss Ida Roper, F.L.S., of Bristol, presented, in 1912, "a valuable collection of dried English plants." Thanks to the attention devoted to them by Mr. Sherring, the local Carices (30 species) are well represented in this collection.

THE HERBARIUM OF DRIED FLOWERING PLANTS AND FERNS CONTAINS THE FOLLOWING ALREADY CLASSIFIED AND ARRANGED.

Order	No. of Sheets	No. of Species	Order	No. of Sheets	No. of Species
Ranunculaceae ...	35	27	Plumbaginaceae ...	6	3
Berberidaceae ...	—	—	Primulaceae ...	11	10
Nymphaeceae ...	3	2	Amaryllidaceae ...	2	2
Papaveraceae ...	5	5	Iridaceae ...	5	3
Fumariaceae ...	4	4	Dioscoreaceae ...	1	1
Cruciferae ...	59	48	Liliaceae	17	14
Resedaceae ...	4	3	Hydrocharidaceae ...	1	1
Cistaceae	3	2	Orchidaceae ...	31	25
Violaceae	14	9	Santalaceae ...	1	1
Polygalaceae ...	6	3	Euphorbiaceae ...	9	8
Caryophyllaceae ...	33	30	Urticaceae ...	7	5
Portulaceae ...	2	1	Myricaceae ...	3	1
Hypericaceae ...	7	5	Cupuliferae ...	11	5
Malvaceae ...	3	3	Salicaceae ...	5	4
Tiliaceae	1	1	Coniferae ...	2	2
Linaceae	2	2	Chenopodiaceae ...	22	17
Geraniaceae ...	10	9	Polygonaceae ...	17	13
Oxalidaceae ...	1	1	Thymelaceae ...	1	1
Balsaminaceae ...	2	1	Labiateae A ...	19	15
Celastraceae ...	3	1	,, B ...	24	23
Rhamnaceae ...	2	2	Plantaginaceae ...	4	3
Aceraceae ...	1	1	Ilecebraceae ...	3	2
Leguminoseae ...	69	54	Solanaceae ...	6	4
Rosaceae	59	52	Scrophulariaceae ...	34	29
Saxifragaceae ...	8	7	Orobanchaceae ...	2	2
Crassulaceae ...	5	5	Lentibulariaceae ...	4	3
Droseraceae ...	3	2	Verbenaceae ...	1	1
Haloragaceae ...	2	2	Oleaceae	1	1
Lythraceae ...	3	1	Apocynaceae ...	1	1
Onagraceae ...	7	7	Gentianaceae ...	15	9
Cucurbitaceae ...	1	1	Polemoniaceae ...	1	1
Umbelliferae ...	30	28	Boraginaceae ...	18	14
Caprifoliaceae ...	10	8	Convolvulaceae ...	7	5
Rubiaceae ...	10	9	Gramineae A. B. ...	62	49
Valerianaceae ...	6	6	,, C. D. ...	46	38
Dipsacaceae ...	6	5	Equisetaceae ...	22	7
Compositae A ...	43	36	Selaginellaceae ...	1	1
,, B ...	12	11	Lycopodiaceae ...	4	4
,, C ...	37	31	Characeae ...	3	3
Campanulaceae ...	18	9	Filices	36	30
Vacciniaceae ...	1	1			
Ericaceae ...	6	6	Total ...	1002	802

Geological Collection.

Recent and Pleistocene.—Neolithic arrow-heads, knives, flakes, etc., from Bournemouth district. Collection of palæolithic ditto, also from other parts of England, and some Mousterian, etc., from caves of South France. Bones and teeth from Kent's Cavern. Shells from Raised Beach, near Torquay. Collection of varieties of stones found in local gravel, also silicified wood and meteoric iron from the same. Glaciated stones and boulders from Wales, etc.

Pliocene.—Mollusca from Red Crag and Coralline Crag.

Oligocene.—Fresh-water and marine shells from the various divisions. Land shells and "turtles' eggs," also mammalian bones.

Eocene.—The Dent Collection of Barton Fossils *(see below).* Bracklesham shells. Plant remains from the Bournemouth Cliffs, also from Hengistbury Head, with shark's teeth. Fruit and mollusca, etc., from London Clay. A collection of shells from the Paris Basin.

Cretaceous.—Mollusca, sponges, echini and fish remains from various chalk localities. Also some from the Upper and Lower Greensand and Gault. Wealden fossils and silicified wood from Brook.

Jurassic (Upper).—Crocodile, turtle remains and mollusca from the Purbeck Beds of Swanage. A few Portlandian and Kimmeridge specimens.

Great Oolite.—Specimens, chiefly shells from the Cornbrash, Bradford Clay and Fuller's Earth.

Superior Oolite.—Mollusca and corals.

Lias and Rhaetic.—Saurian bones, jaws, teeth, vertebrae, etc., from various lias localities, with many Ammonites and other shells. Rhaetic fish teeth and spines, reptilian bones and teeth, with many characteristic shells, from Aust Cliff and Blue Anchor.

Coal-Measures.—A good representative collection of plant remains from various coal-fields. A collection from the clay-ironstone nodules of Staffordshire. Some fish remains from Halifax, and a few mollusca. Tree stems and molluscs from the Millstone Grit of Bristol.

Carboniferous Limestone.—A good series of corals, many polished and cut, from Bristol and Ireland. Some valuable fish palates and spines from the "bone-bed" of Clifton. Many shells from Clifton, Yorkshire, Brindoran and elsewhere.

Devonian.—Corals and a few mollusca from Devonshire; fish remains from Scotland.

Silurian.—A fine series of graptolites from Llandrindod. Trilobites from Dudley and other well-known localities. Many corals and molluscs from Wenlock Limestone and other beds.

Ordovician.—Specimens from Wales, Yorkshire and Shropshire, chiefly shells and a few trilobites.

Petrological.—(1) Local: A series of flints and other stones, found in our local gravels. Specimens illustrating the effects of faulting upon chalk and flints from the Purbeck Fault. A series illustrating varieties of flints found in local deposits from the chalk. (2) Stratigraphical: Specimens illustrating the mode of deposition and subsequent alterations of stratified rocks of various ages under different natural conditions; many local. (3) Igneous Rocks: Specimens of the more important varieties of granites, basalts, diorites, etc., from many localities.

The above include collections of fossils which, though not actually in the possession of the Society, Dr. W. T. Ord, F.G.S., hopes eventually to hand over for incorporation in the main collection. At present the difficulty is to provide cases and the means for mounting and adequately displaying the specimens.

The Dent Collection.

The following brief description of the Dent Collection of Barton fossils is taken from the Presidential Address given in November, 1913:—

The collection was brought together many years ago by the late Mr. Dent, of Barton Court, and his father, who were owners of the cliffs. It was described by Mr. Henry Keeping, curator of the Museum at Cambridge, as "one of the best in the world, probably only equalled by the Edward's Collection in the British Museum and the one at the Sedgwick Museum at Cambridge." Before the collection was purchased it was carefully examined in behalf of the Society by an expert from the British Museum, who reported: "All the fossils are in a fine state of preservation, and such a series will probably never be obtained again."

There are 800 specimens of vertebrate animals and 3,375 fossil shells. Some of the latter are of exceptional interest. There are several specimens of the rarer species showing slight variation; also the gradual changes in course of development from the young to the adult stage. Of some species there are more than 100 specimens. Some of these will be useful later for exchanges with other museums.

One of the Barton Molluscs (*Xenophora agglutinans*) is somewhat remarkable. Its living representative is known as the Carrier Shell. It possesses the singular habit of accumulating during the formation of its shell different substances, such as stones, corals, small shells, etc., which adhere to the shell and are carried about with it as it moves like a small tortoise along the sea bottom. When at rest it presents the appearance of a heap of stones casually thrown together. It is possible that by such means it escapes the notice of its emenies; while at the same time it may increase the resisting power of the shell.

There are in the collection six adult specimens of *Hippochrenes ampla*—one measuring $8\frac{1}{2}$ inches by $6\frac{1}{4}$ inches—in excellent condition. Of the genus *Murex* there are numerous species. *Murex*

asper is armed with formidable spines. The more recent species were remarkable for the beauty and variety of their spines. and highly esteemed from the earliest ages on account of the dye they yielded. The purple robes of the Romans owed their colour to these molluscs. *Murex tenuispina* is known as Venus's Comb. The Pectens or Pilgrims' shells are familiar fossils of the Barton beds. In olden days one of the large scallops was worn by pilgrims in front of their hats as a sign that they had visited the shrine of St. James in the Holy Land.

Perhaps the most interesting fossils amongst the vertebrates are the bones of an extinct whale-like animal known as *Zeuglodon* (yoke-toothed). Such relics are said to be very uncommon in museum collections in this country. The British Museum possesses no parts of this animal from the Barton beds. The *Zeuglodon* was a Tertiary mammal described by Sir Richard Owen from the peculiar form of its molar teeth. The animal was probably about seventy feet long, and its habits were evidently carnivorous. The larger vertebrae, over a foot and a half long, were formerly so abundant in Alabama, in the Southern United States, that they were used for making walls or burned to get rid of them. On this side apparently the animals were comparatively rare. Other mammal relics are the teeth of *Anthracotherium*, an extinct animal intermediate between the river hog and the hippopotamus. In the lignites of Savone remains of carnivores, mansupialia, bats, birds, crocodiles, tortoises, and fish occur along with those of the *Anthracotherium*. It is not improbable, therefore, that similar animals were more or less associated with the *Anthracotherium* of the Hordwell oligocene deposits in this country. The fish remains consist of the palates and spines of monster skates or rays (*Myliobates*), described by Mr. Buller Newton as "very choice." Some of the latter, he said, may have been obtained from the Bracklesham beds of Sussex. It may be interesting to mention that the relics of the *Myliobates* (*mylias* a millstone and *batis* a thorn-back), also known as Eagle rays in ancient days were remarkable for the extraordinary development of the median teeth in both jaws. Instead of pointed teeth they had flat tesselated dentary plates in each jaw, composed of distinct pieces, juxtaposed and connected by their margins, and united by fine sutures. These "milling" and "grinding" teeth occur abundantly in Tertiary strata. About twenty species have been found in the Isle of Sheppey, while only five species of existing *Myliobates* are known. There are also about three hundred specimens of teeth of sharks. They are mostly of one or two species.

Zoological Collection.

The collection in this branch is not yet far advanced owing to the exigencies of space and cases. Possibly one of the most interesting is the exhibit of Ecdyses (moults) of the common crab, over a period of three years, presented by Mr. J. H. Waddington,

F.L.S. A photograph of this appears in the frontispiece to the Proceedings Vol. II., 1909-10; a similar photograph of the Ecdyses of the Lobster, also presented by Mr. Waddington, forms the frontispiece of Vol. I. of the Proceedings. They are both of an interesting character. The lobster series was presented to the Natural History Museum. The other specimens consist of skulls of the cat, dog, fox, and rodents; a large number of shells of fresh water and marine origin; a few cases of butterflies, in good condition, and a number of named specimens preserved in bottles, presented by Dr. J. R. L. Dixon, a former secretary.

The Natural Science Society has recently received many gifts of botanical, geological and zoological specimens. It is hoped that other gifts will be offered from time to time, especially *of objects of local interest*, which will be gladly welcomed. Letters on the subject may be addressed to the Hon. Secretary, Natural Science Society, Municipal College, Lansdowne.

The Geology of the Bournemouth to Boscombe Cliff Section.

By Dr. William T. Ord, F.G.S.

The completion of the Undercliff Drive has now closed this most interesting section to geological investigation. The time is therefore opportune for putting on record the result of some years study of these strata, especially as little seems to have been published on the subject in geological literature since the appearance of Mr. Starkey Gardner's two exhaustive papers on the Bournemouth Beds in the Journal of the Geological Society in 1879 and 1882 (vol. xxxv., p. 209, and vol. xxxviii., p. 1). During the thirty years that have since elapsed many changes have taken place in the cliffs from continual falls exposing fresh beds and destroying those previously visible, some features recorded by Mr. Gardner have vanished and others have appeared which deserve notice. Palæontologically there is but little to record, for unfortunately more than half the magnificent collection of Eocene leaves, fruits and other plant remains made by Mr. Gardner, and now in the British Museum (Natural History) at South Kensington, remains undescribed, most of the specimens being un-named or identified. I have taken a number of selected specimens from my own cabinet, and the collection of our Society, to London, and in spite of the kind assistance of our former President, Dr. A. Smith Woodward, in placing the whole collection under his care at my disposal, have been unable to name the majority of them. However, Dr. Woodward assures me that this defect is soon to be remedied, and that the palæo-botanist recently appointed will

presently take in hand the Eocene flora. We may then discover in the various collections made since 1880 fresh finds of importance.

The last visit of the Geologists' Association to this neighbourhood was in 1910, when, on May 17th, it was my privilege to conduct the party along this section of the coast.* The Bournemouth Natural Science Society (Geological Section) accompanied me in a final examination of the beds on May 15th, 1912,† since when the Undercliff Drive works have prevented further geological study. It seems probable, however, that there will be frequent heavy falls of rock on the new section of the drive, the cliffs of which are far more pliable than those of the first completed portion, and in these falls portions of leaf beds may be found from time to time if carefully searched for.

DIVISIONS OF EOCENE STRATA IN THE BOURNEMOUTH DISTRICT.

(According to J. STARKIE GARDNER, with thickness in feet added).

Upper Eocene	Barton Series	1. Upper	Barton Sands	Estuarine and Marine ...	90 ft.	
		2. Lower	Barton Clays	Marine ...	110	,,
Middle Eocene	Bracklesham Series	1. Upper	Highcliff Sands	Marine ...	25	,,
		2. Middle	Hengistbury Head Beds	Marine ...	45	,,
		3. Lower	Boscombe Sands ...	Marine ...	110	,,
	Bagshot Series	1. Upper	B'mouth Marine Beds ...	Estuarine and Marine	700	,,
		2. Middle	B'mouth Freshwater Beds	Freshwater		
		3. Lower	Poole Pipe Clays ...	Fluviatile		
Lower Eocene	London Clay			Marine ...	100	,,
	Woolwich and Reading Beds.			Marine and Estuarine ...	70	,,

This classification is by far the most convenient for local purposes, but has not been generally accepted owing to difficulties of correlation with Bracklesham and Bagshot beds elsewhere. The chief difficulty consisting in the fact that it is impossible to compare land plants with marine animals, since the Bournemouth series contain only the former, and the Bracklesham series only the latter. Mr. Clement Reid * therefore advises a lower division to include the Poole (Lower Bagshot) and the Bournemouth Freshwater Beds, and considers that there exists a gradual upward passage thence into the more marine conditions of the Bracklesham Beds. In this case Gardner's Bournemouth Marine Beds, or Upper Bagshot series, would represent these passage beds, and (according to the Geological Survey) be included in the Bracklesham. Locally this would be inconvenient, for the transition from fresh water to marine conditions is gradual, and difficult to discern, owing to the scarcity and ill-preserved nature of the few marine fossils found, whilst the change from the marine beds of the Bournemouth series to the yellow and white sands and

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* Proc. Geo. Assoc., vol. xxi., p. 518.

† Proc. Bournemouth Nat. Sc. Soc., vol. iv., p. 53.

* "Geology of Bournemouth," p. 3, Mem. Geol. Survey, 329.

shingle-beds of the Boscombe sands—Gardner's lowest Bracklesham—is obvious to everyone, and lithologically most striking. For the purpose of description of our local cliffs it is easier to adhere to Gardner's divisions.

THE CLIFFS AT BOURNEMOUTH PIER.

At Bournemouth Pier it was formerly possible to see the remains of a submerged forest, but this has long been concealed by beach shingle and sand, and was last uncovered in excavations for the Undercliff Walk west of the Pier, when beds of peat 8ft. thick, lying in dark blue clay and covered with 9ft. of beach material, were exposed for a few weeks. This old forest was evidently connected with the valley of the Bourne, and its former extension seaward, for its remains ceased about 70 yards west of the Pier and were not found east of it.

From the Pier the cliffs rise gradually to the east, the edge of the Bourne Valley being about 300 yards from the commencement of the ascent. On the west side the ascent is slightly more gradual, owing to its nearly coinciding with the dip-slope of the Freshwater Beds (middle Bagshot), of which it is composed. The total width of the valley is about 700 yards from bluff to bluff. The strata at this point, forming the western extremity of the east cliff, consist—from the beach level to a point some 250 yards up the slope—of Bournemouth Freshwater Beds. They are covered by a thinned-out layer of the Bournemouth Marine (Upper Bagshot) Beds. Fifty yards further up the cliff eastward we come upon the westerly edge of the Boscombe Sands or Lower Bracklesham of Gardner. (Plate XV. Fig. 1). These two latter beds terminate here and are not found in the west cliffs, which are composed entirely of Middle Bagshot (Freshwater) Beds. On each cliff is a capping of Plateau gravel of diminishing thickness downward, which I have traced on the east side of the valley about half-way down the slope, but on the west side its edge cannot be defined. This fact suggests that the valley had been excavated to half its present depth in glacial or pre-glacial times, for it was at the close of the glacial period that the lower gravels were deposited which cap the cliffs. The study of the Plateau Gravel is of great interest and importance, but I do not propose to consider it here beyond recognising its presence in a fairly uniform sheet from 3ft. to 12ft. in thickness along the summit of the cliff section. It lies upon an eroded surface of Lower Bracklesham (Boscombe Sands) and consists chiefly of subangular flints having a deeply ochreous patination.

THE BOURNEMOUTH FRESHWATER BEDS.

These are the Middle Bagshots of Gardner and are found in our section only from the Pier to the East Cliff Lift, where they merge into Marine Series both horizontally and vertically, it being impossible to accurately define the junction. Their full develop-

ment can be studied from the Pier westwards to Canford Cliffs, and it was from this section that the important and varied collections of sub-tropical plants that have made the Bournemouth "leaf-beds" so celebrated were obtained. Their termination east of the Pier has not yielded much palæontologically. The section begins with a low cliff of yellowish sand with little or no clay. But about 200 yards thence drab coloured clay appears in the upper part and gradually descends eastwards, until at the Zig-Zag it stands out as a clay bluff about 25ft. in height, the more fragile sandy upper beds having been more rapidly denuded back recede somewhat from its front. (Plate XV. Fig. 1). In this clay bed Gardner describes* the last leaf-bed (proceeding eastward) which bore evidence of having been deposited in fresh water. This was in 1879, since when the "slight indentation of the cliff some $3\frac{3}{4}$ yards across formed by a spring," as he described it, has widened and deepened considerably, and the leaf bed he referred to has long since disappeared. Eighteen years ago, however, I obtained some fern leaves from this spot, probably *Polypodium* and *Osmunda*, but the thin layers of pinkish clay which he refers to had vanished. Indeed this fine cinnamon-coloured clay, in which the best preserved leaves used to be found has become increasingly rare of late years, and is now very seldom met with and only in very small fragments.

At this point the beds have greatly changed since the sketch given by Mr. Gardner was drawn, owing to the frequent falls and cutting back of the cliffs. But it is here that the fresh water conditions that prevailed from the west begin to give place to marine influence, which now continues eastward, although the fresh water clay described above does not finally disappear until just beyond the Lift. The beds, however, are greatly broken up both horizontally and vertically and for some distance beyond both the lower clay series and the marine beds above them. The plant remains found in various patches of clay here suggested a marshy vegetation, whilst some fresh water *Unios* were found by Mr. Gardner, as well as remains of a shore-crab, of which I found a specimen some four years ago, all of which indicates that "this was the actual debatable margin betwixt sea and river, beyond which, to the west, it seems clear the encroaching sea never in these ages penetrated."*

The last of the Fresh Water Beds (Middle Bagshot) disappears below the beach just beyond the Lift. (Plate XV. Fig. 2). The cliff face here has always been so obscured by falls and washings from above, that I have seldom been able to trace it. But some years ago after a severe storm it was well exposed at the beach level,

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* Quar. Journ. Geol. Soc., vol. xxxv., pt. 2, p. 225.
* Op. cit., p. 227.

and exactly corresponded to Mr. Gardner's description.† A compact bed of dark bluish clay was seen, containing quantities of vegetable fragments. Stems, twigs, some being pyritized, with various dicotyledonous leaves, and also seeds and fruits; one of the latter, probably *Cupressus*, I have been able to preserve. In the upper beds thin layers of lignite occur, and can be traced continuously for many yards, often between layers of carbonaceous sand. Blocks of teredo-bored wood are also common, the sandy clay filling the borings being often pyritized.

Beyond this point the Fresh Water Beds give place to those that have been deposited under marine conditions, but in which numbers of plant remains carried down by the river, and its tributary streams, are found.

BOURNEMOUTH MARINE BEDS (UPPER BAGSHOT).

Commencing at the top of the East Cliff, about 250 yards from the commencement of its rise, the Marine Beds of the Bournemouth Series, dipping very slightly E.S.E., extend to Southbourne and disappear into the Beach a few yards beyond the site of the former pier. They are covered continuously by the Boscombe Sands, and form rather more than the lower half of the cliff between Bournemouth and Boscombe, but beyond that, sinking gradually towards the beach, the Boscombe Sands form an increasing portion of the cliff face, as one proceeds eastward. These are the beds described as Bracklesham in Mr. Clement Reid's pamphlet.* It is impossible accurately to estimate the proportionate thickness of the three divisions of the Bagshot Series in this district—I have given the total as 700ft. in the table of strata on p. 118—owing to the impersistence of the beds, and irregularity of the dip, but the middle series of Marine Bagshots is probably well over 200ft. in thickness. It consists of sands and clays in various proportions, with but few continuous beds, there being great irregularities in deposition with evident current bedding. Many of the beds are curved vertically, especially the more sandy ones, indicating their origin from sandbanks in the old river channel, which probably frequently changed their positions. The clay beds tend to lie in larger masses, and are thicker than in the Lower Bagshot, west of the pier. The section we are now describing is partly estuarine, and was probably formed at the river's mouth. It contains a large proportion of black, or brown, vegetable debris, often deposited in layers, but also disseminated throughout both the sand and the sandy-clays, so that a somewhat dark colour is imparted to the whole section, which contrasts strongly with the lighter beds of the Boscombe Sands above, and of the Freshwater beds west of the Pier. This is caused by the presence of comminuted lignitic material supplied from the floating wood brought down by the river, for here meet-

†Op. cit., p. 224.

* "The Geology of Bournemouth," Mem. Geol. Surv., p. 7.

ing the sea it was dashed to pieces and ground up by wave action into fragments of all sizes. These fragments were sorted by gentle currents and tidal ebb and flow, and deposited amidst the sand and mud at the river-mouth.

Perhaps the most significant evidence of marine influence exerted near the mouth of a great river is afforded by the trunks of conifers and the masses of coniferous wood frequently formed in the cliffs. (Plate XVII. Fig. 2). They occur all along the section, but are especially common after heavy gales, when the fore-shore has been much disturbed by wave action. Then, at low tide, fragments of black lignite of all sizes up to two or three feet long may be found in abundance. These are nearly always teredo-bored, the holes being usually filled by green pyritized sand or mud. They are difficult to preserve, usually splitting and crumbling away by contraction on drying. In the sandy beds in the cliff face occasionally large tree trunks, many feet long and sometimes a foot in diameter may be seen. These are usually very fragile and crumble to the touch. They are riddled by teredo borings, which are filled with sand. Occasionally in a mass of sand may be found sandy or clay casts of teredo borings, which resemble worms or worm casts, these represent all that is left of what was once a tree trunk, the woody matter having entirely vanished or remaining only as a trace in black lignitic sand surrounding the casts. All this woody material in the various forms described was formerly drift-wood floating about in the estuary of the river and in back-waters or side-channels. The same phenomenon occurs to-day at the mouths of great rivers, especially when these are obstructed by mud-banks and shallows. The wood is rapidly attacked, bored through and through by the teredo, until sometimes a mere shell of wood remains, this becomes water-logged and sinks. The holes then are filled up by mud or sand, and the fragments buried in the river deposits. The great quantity of this wood found in our Bournemouth beds testifies to the size and importance of the ancient river, and to the richly wooded country through which it must have flowed in its course from the west.

At "Steps Chine," as it used to be called from Meyrick steps which led to the beach before the present Zig-Zag Path was made, imperfect casts and impressions of mollusca were found on an occasion when the beds were less obscured by slips than usual. This was rarely the case in Mr. Gardner's time, and I have never been fortunate enough to find any. Probably they occurred in a local patch, which has long since fallen. It was possible, however, to recognise an *Ostrea*, *Arca*, *Modiola*, *Tellina*, *Natica*, and *Cerithium*, and in a lower bed a *Unio*-like shell. These, with remains of *Callianassa* and a shore-crab, are evidence of the transition to marine conditions from those of the upper beds, and confirms the opinion that here (and for some distance eastward) mud and sandbanks obstructed the river-mouth and retained much of the vegetable debris brought down by it.

Some thirty yards east of the Lift a leaf bed, which must have been of considerable extent, has for some years yielded masses of mottled pink sandy clay, crowded with leaves, especially *Podocarpus*, *Lygodium*, *Hewardia*, and some flowering plants not yet determined. Many good specimens I have obtained for our museum, and they will, I hope, be shortly displayed and named. The various leaf beds from this position of the cliff have continued to yield occasionally specimens of Ferns, Aroids, Fan-palms, and a Eucalyptus, also traces of a Conifer, as described by Mr. Gardner. The upper beds here, and also a little eastward, afford occasional pockets of white china clay; after which no more occurs. It is commonly found in larger masses beyond the Pier, increasing in a westerly direction.

We now come to a point 200 yards east of the Lift, where, for many years, a shelving bluff of dark grey clay stood out from the cliff face for some distance towards the sea, forming a prominent object from a distance, and the only one of its kind between the two piers. (Plate XVII. Fig. 1). On its east side it formed a little cove, which was originally some 20 yards deep, but had diminished to much less, by erosion of the projecting bluff, when it was finally destroyed by the Undercliff Drive works in 1912. This projecting cliff had escaped erosion owing to a local hardening of the lower marine beds by a mixture of the clay with a fine earthy marl and much pyrites. This bluff was crowded with twigs, fragments of wood and vegetable debris, and was divided into layers by thin bands of lignite. But in the upper part it contained innumerable fronds of a fan-palm, probably *Sabal*, often three or four together in one hand specimen, and many fine examples have been obtained from this spot.

The cliff forming the base of this little cove (Plate XVI., Fig. 1) affords a good illustration of the conditions which prevailed at this spot when the strata were deposited, for the beds are broken up and distorted in an extraordinary way. A mass of quartz sand, some ten feet thick, contains numerous chunks or slabs of brown unfossiliferous clay, jumbled together in great confusion, and of various sizes, from that of an orange to a foot or more in thickness. (Plate XVI., Fig. 2). These are not rolled, but roughly quadrangular, and appear to have been torn from a clay bank, in the estuary of the river, which must have been broken up under the violence of a great storm. Great waves have dashed together these masses of clay with sand from a neighbouring sandbank, and have redeposited the whole as a sort of clay "breccia" in sand as we now find it. The sand matrix contains much pulverized lignite, but is otherwise white or grey in colour.

Above this the cliff shows sand of a lighter colour, and evidence that it was deposited under much calmer conditions than the lower beds is afforded by the fact that it contains numbers of leaves, many beautifully preserved and exhibiting the venation quite clearly. Some have thin patches of pink clay adhering to

their lower surfaces, showing that they had been gently washed out of a neighbouring leaf bed to be redeposited, partially or wholly washed free from clay, in sand further down the river-bed. This could only have been done by a very gently flowing current, dissolving and washing the clay matrix in which they had lain whilst their structure was yet firm and undecomposed. Unfortunately these leaves can not be preserved, but crumble into the sand at a touch. A few yards further on current bedding was formerly evident, also clay beds, curved on the upper surface and overlayed by thin bands of lignite. Sometimes three or more of these, each separated by a thin band of clay, were seen curving over an old mudbank, and representing, probably, the effects of a succession of high tides near the ancient river-mouth. A section of the cliff, with measurements at about this point, is given by Mr. Gardner,* and it remains approximately correct at the present time. With slight modifications it is as follows:—

	ft.
Plateau Gravel	5
Boscombe Sands:	
Orange and Yellow Sand, about ...	20
White Sand	14
Estuarine and Marine Beds of Upper Bagshot:	
Irregular Clay and Clayey Sand, drab or ochreous	4
Greenish Sand	2
Light Grey Sand	15
Lignitic Sand with redeposited leaves and small clay nodules	9
Angular lumps of dark Clay in a matrix of light sand	13
Dark Clay with pyritized stems and lignite	6
Quartz Sand with clay seams	2
Total ...	90

At the point just described, and in many places where clay beds form the lower parts of the cliffs, a yellow or occasionally dirty white efflorescence is frequently seen covering the face of of the clay, sometimes over considerable areas, and even giving the appearance of a yellowish-green lichen. It crumbles to the touch, and disappears after rain, to re-form in dry weather. This has long been regarded as a deposit of *ferrous sulphate*, and it has been formed by decomposition of iron pyrites in the higher beds yielding a sulphate which uniting wtih organic matter in the lignitic clays, is then precipitated by evaporation of water on the surface of the cliff. At the last visit of the Geologists' Association this appearance was very marked, and excited much interest.

* Q.J.G.S. xxxv., pt. 2, p. 223.

Mr. Henry Barnes, of Birmingham, took samples for analysis, and kindly sent me the results of his experiments, with permission to publish them. He identified the substances as the mineral *Melanterite*, which is a native Hydrated Sulphate of Iron, having the chemical composition $FeSO_4+7H_2O$. This opinion was confirmed by Mr. Spencer, of the Natural History Museum, South Kensington. The mineral is associated with gummy and resinous matter, which, when dissolved in alcohol, gives a strong smell of turpentine. This seems important, as testifying to the abundance of coniferous wood drifting in the estuary when these beds were deposited, and which probably supplied practically all the lignitic material in our cliffs. Mr. Barnes subsequently wrote to me that, in a visit to the Tyrol, he found a specimen of *Melanterite*, and that at Munich Museum he had been able to correlate the organic matter associated with *Melanterite* as *Succinite*, which is a condensation product from gummy matter derived from the vegetation of the period.

It is curious that this deposit has long been known, and was formerly called "alum," a term vaguely applied to all bitter minerals in pre-scientific times. From its abundance in the neighbourhood, this gave its name to Alum Chine in the West Cliff, and it is stated that the mineral was formerly used to make ink by mixing it with a solution of galls.

The presence of free sulphuric acid in water oozing from the clay beds was first pointed out by Mr. Carus Wilson. Litmus paper is sharply reddened by it, and a strongly acid taste characterizes some of the streams. This acid results from decomposition of pyrites in the presence of organic acids from decomposing vegetable matter. This acidulated water attacks limestones and dissolves mortar, its effects have been clearly shown in destroying concrete in several places, notably in a concrete wall near Boscombe Pier, also at Fisherman's Walk. The amount is not sufficient to injure the Undercliff Drive, as it sinks from the cliff face into the sand, and does not penetrate to the stone frontage. But it is possible that the concrete foundations may be affected by it in certain places after a time. The remedy is obviously to drain the cliff face from every trickling rivulet, and take the water off in earthenware pipes.

About 100 yards nearer Boscombe we come to a point of marked palæontological interest. It has been called the "seed-patch," quantities of small seeds having been found in it. In size they vary from that of a grain of wheat to a hazel-nut, and some fifteen varieties have been noted. They occur at a spot where a tiny stream comes down from the upper beds, and, strange to say, almost entirely at this spot, a few yards east or west it is very rare to find even a stray one. They are supposed to be seeds of *Hightea* and *Cucumites*, and rarely of *Petrophiloides*, but there are many others at present undescribed. Although I have found numbers, they at times cease to occur, only after an interval of a year or two becoming plentiful again.

The spot is undoubtedly that noted in Mr. Gardner's paper, but their surroundings have been entirely different during my observations. I have never seen them "in a patch at the base of the cliff situated between the extremities of two unconformable sandy clay beds," but always in masses of very tenacious blueish-white clay, which have fallen from some feet up the cliff, their precise origin being obscured by washings from the bed above. In this clay the seeds are embedded and invisible until after heavy rain, when the upper layers of clay have been dissolved and washed away, they then stand out on the surface and can be picked off, coated with white clay. There can be no doubt, I think, of their occurring thus in situ. The question arises, how did they come there?

In answering this question it will be convenient to here consider why seeds and leaves are usually found in these clay patches. Although the term "leaf beds" is commonly applied to the Bournemouth strata, there are actually no such beds in the sense of continuity. Leaves occur not in beds, but in lenticular (*i.e.*, lens-shaped) patches of clay. These are usually shaped like a spectacle lens, and lie horizontally in the cliffs, in line with the bedding planes, and usually with their long axes roughly east and west. In size they vary from a few feet to 30 or even 50 yards in length. (Plate XIV.). Clay beds do occur continuously for hundreds of yards, but these are not leaf beds, and usually have no fossils in them, nor are they lenticular in section. The process of exposure of a leaf-bearing clay patch is as follows:—A fall of the cliff face exposes first a thin narrow outer edge of clay, a further fall exposes a longer strip, which thins out at each extremity. If a fall slices off a surface of cliff which cuts the clay through its long axis, we have the largest exposure possible for that particular leaf patch. After this centre-line has been passed each fall exposes a shorter and smaller portion of the inner half of the clay, until a mere streak a foot or two long and an inch or two thick may remain. When this falls the particular "leaf bed," or "clay patch," has gone for ever. It is found that these patches have usually one or two species of leaves characterizing them, whilst only a few stray examples of other leaves occur. It thus happens that certain species tend to be peculiar to certain patches, where they may be very abundant, and but seldom found elsewhere even in adjacent spots.

The explanation of the peculiar mode of occurrence of these clay patches with their leaves, throws a vivid light upon the conditions under which the flora flourished. Each of these patches represents the former bed of a pond, or small lagoon or backwater, through which water bearing clay in suspension slowly oozed and trickled from the swampy ground and marshes lying alongside the main channel of the river. Obviously the land was flat and of low level, for often the river overflowed its banks and swamped these ponds and lagoons with sand-bearing waters carried inland from the sandbanks of the estuary or river-mouth,

which we have seen (p. 122) was close by. The sand sank as the flood water subsided, and was left in a layer upon the clay, to be followed by further layers of clay again deposited in tranquil times. The trees and ferns whose leaves we find in the clay grew in the immediate neighbourhood, and their leaves were carried by wind and floated down by water to these ponds and lagoons, there to be entrapped and finally to sink and be enveloped in the clay at their bottoms, thus were formed layers of leaves embedded in clay. The land appears to have been slowly sinking at this period, and so in time the lagoons and ponds became choked up with sand and thick layers of mud which were deposited over them from the adjacent estuary. These later deposits were usually unfossiliferous, but often contained ground-up woody matter, which formed layers of lignite, all effectively sealing up the leafy clay bed of the former pond, until its remains were again revealed as a " leaf-bed " in our cliff-face of to-day.

The prevalence of certain trees growing together in patches of drier ground, and of ferns and marsh plants flourishing in lower parts, will account for the fact that the clay patches contain leaves of the flora that lived nearest to them, or near which the streams flowed that supplied them. The phenomenon of the seed patch is, perhaps, less easy to explain. It may be that the seeds were retained in an eddy which caught them up whilst the lighter floating leaves were carried on to be deposited elsewhere.

From these considerations it is easy to understand that with frequent falling of the cliffs their palæontological features are always changing. Many of the spots formerly described as yielding certain leaves have long since ceased to do so, the lenticular clay patches having vanished with successive falls of the cliff face. Few, indeed, of those of a decade ago now exist. On several occasions I have found a little patch of cinnamon-coloured clay crowded with leaves in the cliff face, only to be disappointed at finding it thin out and disappear in a few inches, proving that it was actually the last fragment, or innermost edge, of what had been a much larger mass. There can be no doubt that during the last thirty years these leaf-bearing patches of clay have become much scarcer. And the explanation seems to be that as the cliffs fall their face displays sections that are further and further removed from the main channel or mouth of the river. Naturally, the further inland we go the fewer and scarcer would the ponds and lagoons become, as all were fed and maintained by the river and its tributary streams. We must expect, as indeed is the case, that leaves will become scarcer and good specimens more difficult to find each year. And to crown all, the ruthless march of civilization comes at last to seal up forever from geological research what remains of the most interesting section of our cliffs by the new Undercliff Drive!

From some yards eastward of the " seed-patch" to Boscombe Pier the distinction between the lower marine beds and the upper

beds of Boscombe sand is seen very clearly, except where it may be hidden by falls. Heavy, dark clays capping lignitic sands form the lower twenty feet or more of the cliffs, whilst the upper two-thirds consist of white and yellow sands, with occasional pebble beds, capped, as usual, with plateau gravel. Above this are layers of blown sand, which formerly were much thicker—thirty feet was spoken of in 1879—and extended for some distance inland, as do the sand dunes along the new Overcliff Drive beyond Boscombe Pier. Owing to the friable nature of the upper beds from here almost to Boscombe Pier, falls are very extensive and frequent. The lower clay beds stand out far in advance of those above them, but are frequently smothered in talus, and hence invisible. This talus is Nature's method of reducing the cliff face to the angle of rest, at which no further falls would take place, but as the protective talus is continually washed away by the sea, the desired slope is never attained and the falls continue. The new drive will prevent this, but will itself become smothered instead, and its being cleared of falls by manual labour instead of by the waves will in no way protect the cliffs from further sub-aerial erosion. Something, no doubt, may be done by encouraging the growth of vegetation, as has been successfully effected west of the Lift, but the conditions in these more friable cliffs are far more difficult, and it will be impossible to put an end to falls until the cliff top has receded in places far beyond the present road, which will have to be removed further inland in probably a very few years. The process, however, will be much retarded if pains are taken to intercept and drain away the various streamlets of land water which now trickle through the sandy soil and fall over the edge of the lower clay beds.

The Bournemouth Marine Series is here about forty feet in thickness above the beach, consisting of about thirty-two feet of dark sandy clay, with very stiff black or lead-coloured clay for the upper few feet, forming a projecting bluff from which the upper eight feet, consisting of whitish-grey sands, recede abruptly in places owing to their friability and the fact that the impervious clay throws out all land streams. Water that has percolated through the beds above can be frequently seen falling as miniature water-falls from the top of the clay ridge, which presently breaks down, forming V-shaped recesses which are blocked below by fallen masses of clay upon which the water pours. These features illustrate in miniature the first step in the formation of our chines.

The next point of interest is at a spot where formerly some wooden steps descended to the beach. Here sand dunes at the top attain their largest dimensions, for here the prevalent winds striking the cliff face where it is most friable, blow up the sand grains and deposit them above. It is unlikely that any beach sand is carried so high, but clouds coming from the white glass sand occurring so largely in the upper cliffs here can be seen on a rough day whirling inland from over the cliff-edge, after

gusts of wind have impinged upon the face of the cliffs. The sequence of beds is here much the same as in the last section described, except that the lowest sandy beds become darker at the beach level and contain fragments of rolled wood and stems. Here also is the furthest point westward at which *Nipadites* have been found. These fruits are rare except in or near Honeycombe Chine, and so do not enter into our present subject.* This also is the last point eastward where seeds, resembling those in the seed-patch, are occasionally found. A little nearer Boscombe, in the lower beds, which are of very dark, almost greenish, sandy clay, very ill-preserved small round bodies may be detected in splitting lumps of the clay, which lie together in layers. Mr. Gardner identified these as casts of small oysters, and records them as occurring in abundance from here to the east side of Boscombe Pier. As found in recent years, all trace of shell has gone, the beds being entirely decalcified, but since he observes that some of them were coated with Bryozoa, they must have then been better preserved than those I have seen.

For the last 300 yards, to near Boscombe Pier, the lowest beds, averaging 6-10ft. in thickness, consist of dark lignitic sand, crowded with black rolled fragments of wood and stems. They are markedly current bedded, and show evidence of having formed banks of muds and sand which were subjected to frequent disturbance by storms, probably at the river's mouth. Some of these beds are harder than others owing to traces of ferruginous cement, and these could formerly be seen standing out in ridges and small bluffs. No leaves, seeds or fruits have I ever found in them, in fact, this woody matter which composed, perhaps, a third of their substance has been so ground and pounded by wave action that no perfect forms could survive. As evidence of local hardenings I can recall that for many years a hard, isolated mass, about the size and somewhat of the shape of the toad-rock near Tunbridge Wells, stood upon the beach some twenty yards from the cliff face. This was gradually worn down, largely by children climbing on it, until its much diminished base was at last destroyed by the Undercliff Drive works.

From here there is little to observe in the lower marine series until arriving at Boscombe Chine. The beds there dip at about 8 degrees, and it could formerly be seen within the Chine —this is now hidden by sand—that they rise rather rapidly inland. The western bluff guarding the end of the Chine has been formed by wind denudation. The upper friable beds having been denuded back some years ago by southern and south-easterly gales impinging upon it and rushing up the Chine. Thus a plateau has been formed for some yards upon the harder beds of the marine series, which were unaffected by wind-action; thence there is a gradual slope upwards to the cliff summit.

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* For a full account see article by Sir Daniel Morris in Proc. B'mth. Nat. Sc. Soc., vol. iii., p. 78.

THE BOSCOMBE SANDS (LOWER BRACKLESHAM).

These form the lowest beds of the Bracklesham Series in our district, according to Mr. Gardner's division, or, if the arrangement of the Geological Survey is accepted as described by Mr. Clement Reid, the Bournemouth Marine Beds, upon which lie the Boscombe Sands, are regarded as being the lowest of the Bracklesham. They commence in the upper part of the cliffs, near Bournemouth Pier, (Plate XV., Fig. 1), and gradually increasing in thickness, form the mass of the cliff beneath the Plateau gravel, lying upon the Bournemouth Marine Beds as far as Southbourne, where the latter dip beneath the beach. Owing to the easterly dip of all strata—except the Plateau gravel—they increase in thickness throughout the section as the lower beds descend to the beach level. Thinning out westward, near Bournemouth Pier, their thickness increases to 50ft. at the highest point of the cliff eastward, before Boscombe Chine is reached.

These Bracklesham beds consist of irregularly stratified layers of white and yellow sands, interspersed with shingle beds of well rolled flints, which have been derived from the chalk. The flint pebbles are mostly small, but a few larger ones occur, chiefly east of Boscombe Pier. They are "battered," that is, they bear concussion marks, caused by their having been dashed about by wave action on a sea beach. In this they differ from the flints from the Plateau gravel which covers them, the latter showing no such marks. The Bracklesham pebbles are faintly patinated white or grey in contrast to the deep ochreous flints of the gravel. There is, however, some 300 yards east of Boscombe Pier, a patch of flints having a bright yellow patination, but this is purely local. Many small black or brown pebbles, derived from Woolwich and Reading Beds also occur. Lastly, the completely rounded or oval form characterizing the Boscombe Sand flints is persistent and significant.

The distribution of sand and flints is very irregular, and affords evidence of their having been frequently moved and redeposited by wave action. The pebbles sometimes occur in layers, resembling shingle beds, at other places in thick, continuous masses. The sand grains are dull yellow or brown, consisting of partly rounded or sub-angular quartz particles, stained with limonite in the darker varieties. The whiter sands frequently occur in pockets and sometimes are of great purity, forming an exceptionally perfect glass-sand. The sands have no cohesion and readily blow away from the cliff face. Mr. Gardner observed that the sand pockets were frequently lenticular in section, and suggested that they indicated cross sections of ancient channels parallel with the old shore.* The darker sand is sometimes feebly cemented in irregular bands, resembling current bedding, by traces of limonite, but can nearly always be crumbled by the hand. A rare

* Q.J.G.S., 1879, vol. xxxv., p. 219.

exception is the occurrence of a thin band of feruginous sandstone. This can still be seen near the top of the Zig-Zag, whence I have traced it eastward for some distance. (Plate XV., Fig. 1).

The Boscombe Sands, although of Bracklesham age, are entirely unfossiliferous, except for the usual chalk fossils—sponges, echini, and a few mollusca—found in the flints. There can, however, be no doubt that the beds represent an old sea beach of sand and shingle that indicates marine invasion of the estuary of the ancient river that laid down the Bournemouth Beds, and covered them with its litoral deposits. How far west the sea invaded the river mouth we do not know, as these beds have, doubtless, been denuded off a large area in that direction. Its gradual approach from the east, where the beds are thicker, indicates a subsidence of the previous river bed, and a comparison of fossils from other Bracklesham strata shows that this coincided with a change to a warmer climate from the sub-tropical conditions that prevailed before its advent. The absence of fossils in our cliffs is largely due to the fact that, owing to their porous nature and nearness to the surface, the beds have been entirely decalcified, and all the usual organic remains that they contained have been dissolved out by percolating waters.

THE BUILDING OF THE BOURNEMOUTH CLIFFS.

Reference has been made in the preceding pages to the ancient river by which the Bournemouth Beds of Bagshot age were laid down. Following the excellent method adopted by Mr. Jukes-Browne in his "Building of the British Isles," it may be of interest to briefly trace the geological sequence of events and the work of this river in the district.

At the close of the Cretaceous period England slowly emerged from the deep sea in which the chalk had been deposited. As the sea receded, rain, rivers and sea-erosion commenced the work of destroying the newly-formed land. The chalk being washed away, the flints enclosed in it were rapidly rolled into black pebbles on the sea-beaches which fringed the shores. This was done precisely as it occurs to-day and can be seen, for example, at Arish Mell and in other chalk-enclosed coves. These flint pebbles were rapidly spread over the bed of the shallow sea which then covered South Hampshire and Dorset, and they formed the first deposit in the recently elevated chalk floor. A few rivers bringing down sand and mud interspersed it with the pebbles. So were formed the Woolwich and Reading Beds, which lie upon an eroded surface of chalk, as can be seen at Alum and Studland Bays. This period was closed by a subsidence throughout the area, which greatly deepened the shallow seas of early Eocene times. The land was now far off, and the deposits then formed were of clay brought by distant rivers, which probably opened into the sea far to the east and south-east, there being no shore line in this district. This was the period of the London Clay which lies upon the Woolwich and Reading Beds.

It thins out westward, but rapidly thickens to the east, whilst nearer the river-mouth, which seems to have been at Sheppey, in Kent, abundant remains of tropical fruits, turtles, sharks, and other fish testify to the tropical climate which then prevailed. No fossils are found at Studland, but in the London Clay of Alum Bay some marine shells occur. At the close of this period the sea-bed was gradually raised, much of the London Clay being probably planed off in the process. An extensive but low-lying land surface, extending for many miles into what is now the English Channel, and northward to a little beyond the Thames Valley, now appeared. Through this flat country a large river flowed down from the west. No doubt this began in a small way, but, as the westward land slowly rose, the drainage area greatly increased until it became a mighty river which, in size, rivalled the modern Ganges or Mississippi. Its watershed included a vast land area in Devonshire, Cornwall, and far out into the Atlantic, much of which land has since vanished. At the commencement of the Bagshot Period this river entered the sea near Selsey Bill, and its width, as evidenced by the Bagshot Sands in this district, must have been many miles. It was shallow and sluggish, though subject to floods which carried its waters occasionally far to the north, and probably also to the south. The material brought and deposited shows that the river drained a great granite district, for the quartz sand and pipe-clays have been derived from decomposition of granite. The same process is now proceeding on a small scale in deposits left by streams from Dartmoor, and, in Cornwall.

During the Bagshot Period the land began to slowly sink again, and the sea to gradually encroach upon the river's mouth from the east. As we have seen, this occurred in three stages, during the first of which the pipe-clays of Corfe and around Poole Harbour, and the variegated sands of Studland were formed. No leaves are now found in these clays, probably because they are worked at a lower level, but formerly they were abundant, consisting chiefly of deciduous forest-trees, fig-leaves, Leguminosae, Aralia, Myrtle, and others. These were considered by Mr. Gardner as of the same age as the leaf beds of Alum Bay, and belong to the Lower Bagshot Period. The Alum Bay bed has however, now been worked out, and no leaves have been found there for some years.

Following these pipe-clays and sands of the Lower Bagshot age, we find a gap of probably 100 feet of strata which have been denuded off where Poole Harbour now exists, and we next meet with the Middle Bagshots or Bournemouth Freshwater Beds in the cliffs from Canford to Bournemouth. The conditions as revealed in these strata had evidently changed. The river had become more rapid, for pipe-clay only occasionally occurs in pockets, indicating little backwaters where the current was very feeble and permitted the fine clay to deposit slowly. But the bulk of the white clay was carried out to sea in solution and had few oppor-

tunities of settling down. The coarser clays and muds take the place of the finer varieties and much more sand appears, all indicating that the river mouth was then much nearer. The flora of these beds is much richer and more varied. Palms and ferns are found mingled with leaves of forest-trees, Beech and Oak leaves occur for the first time. This may indicate that the current being more rapid, leaves were brought further down the stream before being decomposed and sinking. Mr. Gardner considers† that the western beds indicate an upland flora, the leaves of which have been shed from luxuriant forests, but those nearer Bournemouth suggests trees or bushes growing in a more barren tract. Near the pier, as we have seen above, evidences of marshy land appear, with many ferns, such as *Osmunda* and *Gleichenia*.

The river depositing the various materials it brought down so abundantly, maintained its bed at about the same depth, and the thickness of material deposited kept pace with the slowly sinking land. But at length the sea encroaching from the **east** reached Boscombe and between that point and Bournemouth Pier, during the deposition of the Bournemouth Marine Beds, the battle between fresh-water and sea-water raged for many years, the mouth or estuary of the river varying in position with the seasons, floods, tides and storms. Thus were produced the irregularly bedded and confused layers of strata which we have described in preceding pages.

This period was closed by the final victory of the sea. The land sank still further, the river-mouth retreated far to the west, and the marine sands and beach shingle-beds of the Boscombe Sands were formed over the Bournemouth Beds, effectively sealing them up to be only revealed in the then far-distant future, when the sea having carved out Bournemouth Bay the old river beds were brought to light for the modern geologists. But between these two events a considerable thickness of strata which has now been denuded off lay over the present cliffs. Above the Boscombe Sands came other Bracklesham Beds, the Highcliff Sands, Hengistbury Head Beds, and then the Barton Series. All are now found to the east, and each of them has a slight easterly or north-easterly dip. Again over these came the Long Mead End Sands. None of these beds have left any traces in the Bournemouth district or west of it. But in the case of the next series—the Oligocene, which are fully developed in the northern half of the Isle of Wight and the opposite coast of Hampshire, and northward into the New Forest—we have evidence that they once extended over Bournemouth at least as far as Creech Barrow in Purbeck, for that conspicuous hill is now known to be an outlier of Oligocene Beds. The total thickness of these various beds above the Boscombe Sands is several hundred feet, and they were probably denuded off by sea encroachment during Miocene times, when England was dry land. At that time a plane of

† "Brit. Eocene Flora," vol. *i.*, p. 17. Proc. Palæontographical Society.

marine denudation must have been formed over this district, leaving Creech Barrow as an island, but levelling off the land generally to the surface upon which subsequently the Plateau Gravel was deposited. It must be remembered that the whole district during Eocene times was comparatively level, there were no hills. It was during or near the close of Miocene times that the chalk ridge forming the axis of the Isle of Wight and to the west the Purbeck Hills was raised up as a great anticline. This was accomplished by the mighty earth movements which characterized that period, and so was formed—with the corresponding northern chalk hills of Hampshire and Dorset—what is known as the Hampshire Basin. This great depression of the Cretaceous strata forms the foundation upon which repose the Eocene strata of the district. But it must be remembered that originally when they were deposited it was a comparatively level plain. It is as a result of these earth movements of Miocene age that the Eocene strata have been preserved in the hollow so produced, for beyond its protecting area, as between the Hampshire and Thames basins, the Tertiary Beds have been removed by denudation. But for this our Bournemouth cliffs would never have existed as they do now, and we should have been living in a chalk district with chalk cliffs similar to those at Margate and around the coast of Kent. We may well be thankful that the mighty earth movements of a long past age treated our district so kindly, otherwise Bournemouth would have had no pines or chines, and its chief distinguishing charms would never have existed.

List of the principal Minerals found in the Bournemouth cliffs:—

Limonite.
Marcasite.
Magnetite.
Glauconite.
Quartz.
Chalcedony.
Jasperite.
Flint.
Rutile.
Zircon.
Kaolin.
Melanterite.
Succinite.
Lignite.

Library of the Bournemouth Natural Science Society.

The following is a list of some of the more important books in the Society's Library :—

SERIAL PUBLICATIONS.

The Archæological Journal. Vols. 1-62.
Knowledge. Vols. 1-27, and all of the New Series.
Royal Institution "Proceedings." Vols 1-17.
British Association "Reports." Vols. from 1867 to 1909 with British Association Handbooks for Sheffield, York, Dublin, and Birmingham.

GEOLOGY.

Geology in the Field. Geological Association Jubilee Number.
Zones of Chalk (Dorset and Isle of Wight) by Dr. Rowe.
A Monograph of the British Eocene Flora. Vols I. and II.
The Geological Memoirs for the Bournemouth, Southampton, Salisbury, Newton Abbot, Chichester I in. geological maps.
Various Papers by C. Reid, F.R.S., on the local formations.
Geology of Sussex, by C. Reid.
Palaeontographical Society's Vols. for 1910 and 1911.
Various Papers on the Geology of the "Isle of Purbeck."
Brander's "Hampshire Fossils."

BOTANY.

The Floras of Dorset, Bournemouth, and Hampshire.
Various Papers and Books on General Elementary Botany.

ZOOLOGY.

Geographical Distribution of Animals, by Dr. A. R. Wallace.
The Book of Nature Study, edited by Prof. Farmer.
A large number of papers on special subjects and general collecting.

ASTRONOMY.

Astronomical Papers (Harvard College).
Journal of the British Astronomical Association.
Memoirs of the Royal Astronomical Society.

GEOGRAPHY.

The "Geographical Teacher," to date.

ARCHÆOLOGY.

British Antiquities (North Wilts).
Architectural Handbook of Glastonbury.
Romano-British City of Silchester.
Memorials of Old Hampshire.
Old Sarum Excavations.
The Barrows of Dorset.
Some Dorset Manor Houses.
Black Book of Southampton. Vols. I. and II.

PROCEEDINGS OF OTHER SCIENTIFIC SOCIETIES.

Complete set of the Volumes of the Dorset Field Club.
Vols. IV. V., and VI. of the Hampshire Field Club Proceedings.
Somerset Archæological and Historical Journal Proceedings for 1904-05-06-07-08-09-10.
Various other Sets of Proceedings of Scientific Societies.

The Journals taken and laid on the table are:—

Knowledge.
The Journal of Botany.
The Journal of Ecology.

Meteorological Notes

for the Year ending December 31st, 1912.

(For the following brief account of Bournemouth weather in 1912 the Society is indebted to "The Annual Meteorological Report for the County Borough of Bournemouth, 1912," issued by the Borough Council).

JANUARY was a cold and very wet month, and snow fell on the 17th and 20th.

February and March were also very wet, and there was a slight fall of snow on February 4th. April was exceptionally dry, with only one slight shower and sunshine above the average. May was pleasant, with 20 very bright days and 10 on which rain fell.

In June and July the rainfall was above and the sunshine below the average of the corresponding periods in the preceding 20 years. August was unseasonable, with much rain and a mean temperature like that of an ordinary April.

In September there was a dry spell lasting 26 days, but heavy rains fell on the 29th and 30th.

The early part of October was fair and pleasant, but the last few days were wet.

November was cloudy and deficient in sunshine, but there was less rain than in any month, except April and May.

In December the mean temperature was above the average, but the rainfall was greater and the hours of recorded sunshine were fewer than usual.

RAINFALL, SUNSHINE AND MEAN TEMPERATURES.

The first line gives the averages for 20 years and the second for 1912.

BOURNEMOUTH RAINFALL.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
20 years	2·57	2·35	2·37	1·86	1·57	1·97	2·04	2·43	2·27	4·53	3·30	3·90
1912	5·43	2·75	4·28	0·04	1·51	4·84	2·32	7·06	2·61	5·23	2·27	4·86

The 20 years work out 31·16 ins.; 1912 works out 43·20 ins., the greatest amount since 1872.

BOURNEMOUTH SUNSHINE (Hours and Minutes).

20 years	66·53	87·44	131·0	170·21	220·35	210·22	229·37	212·15	167·10	112·15	79·2	53·7
1912	49·28	59·15	104·39	259·20	206·18	194·10	162·23	100·17	142·48	137·12	47·21	37·50

The 20 years work out 1,747 hrs. 20 mins.; 1912 works out 1,494 hrs. 1 min., the least since 1894.

BOURNEMOUTH MEAN TEMPERATURE.

20 years	40·5	40·9	43·3	47·6	53·2	58·2	61·7	61·7	58·0	52·0	46·9	43·1
1912	42·0	43·1	47·7	49·7	55·4	57·7	63·0	57·7	55·2	49·2	46·0	46·7

GREENWICH MEAN TEMPERATURE.

55 years	38·6	39·5	41·9	47·3	53·1	59·4	62·7	61·6	57·2	50·0	43·5	39·9
1912	40·4	43·6	46·9	49·6	57·0	59·9	64·6	58·4	53·6	48·2	43·8	45·7

The rainfall in Bournemouth is not the least recorded in the British Isles; fortunately for us it is not, as with our porous subsoil we could well do with twice the amount. Thirty-one inches is very small compared to the rainfall at Stye, in Cumberland, where, taking the average of 19 years it has rained annually to a depth of 170·29 ins. It is also said the Scotch mist on Ben Nevis never lifts, the annual rainfall being 160·78 ins. It will be observed April had the least amount of rain, and the most sunshine with 1 day of 13 hrs. 48 mins.; being 159 hrs. above August.

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Spartina alterniflora, quarter natural size.

Photo by C. P. Raffill, Esq.

Spartina stricta, 3-10 natural size.

Photo by C. P. Raffill, Esq.

MUSEUM
NATURAL HISTORY

Spartina Townsendii, quarter natural size.

Photo by C. P. Raffill, Esq.

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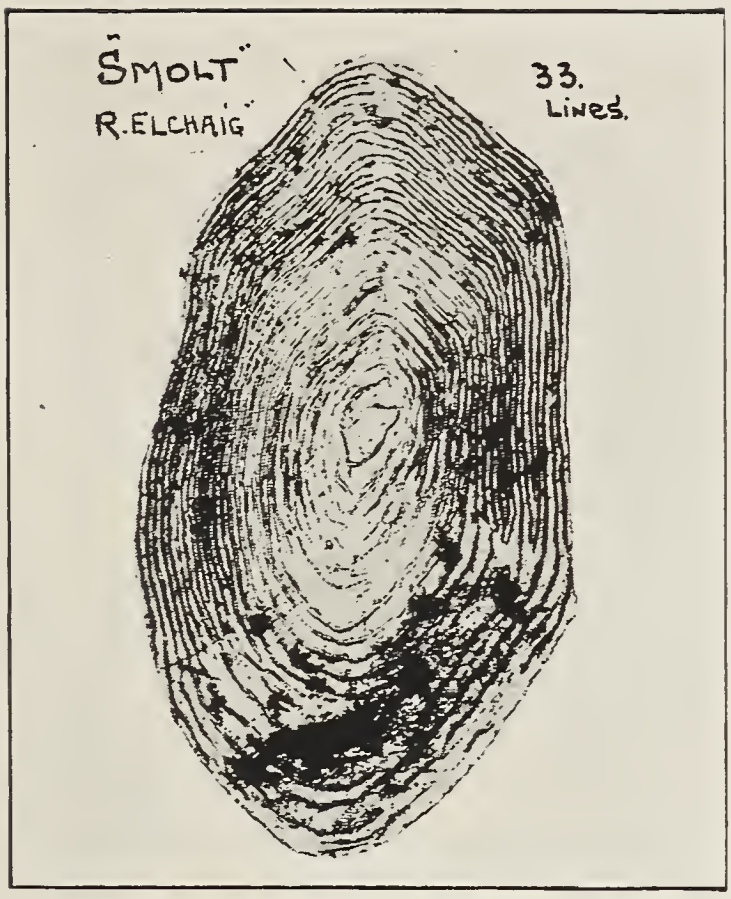
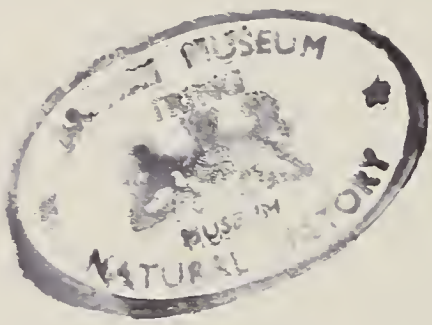


Fig. 1. ×39
Scale of a Smolt, which has passed two years in the river before its migration to the sea.

Fig. 2. ×8
Scale of a Grilse, weighing 3 lbs., length 21¼ inches, age 3½ years. Caught in Falls Pool, Oughterard River. The two years of river life are well marked, also the first winter in the sea at the end of the third year.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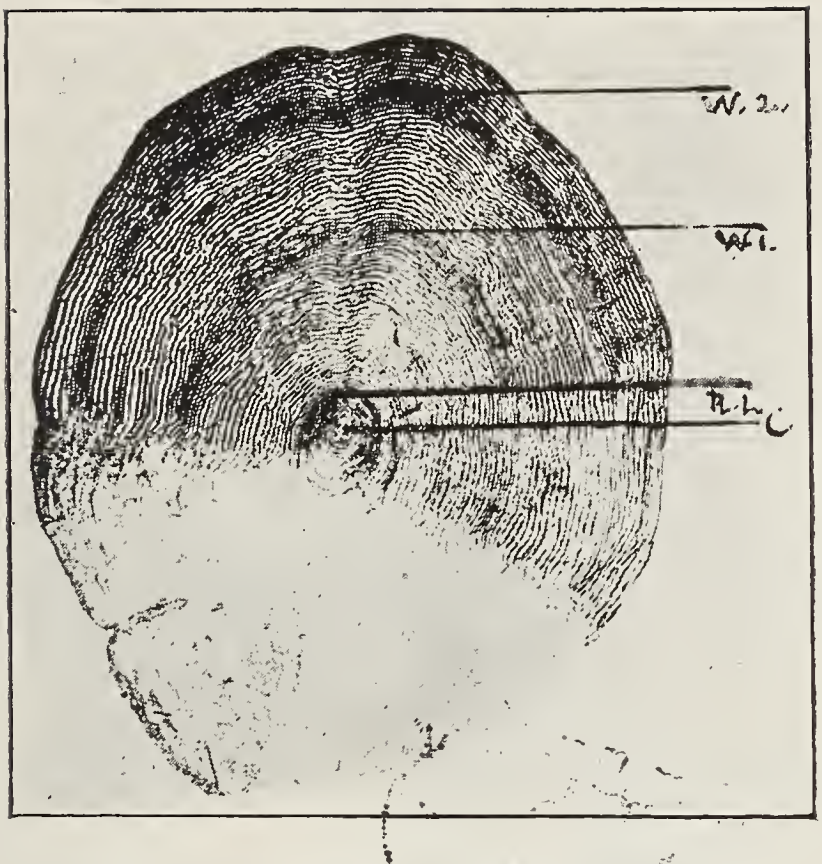


Fig. 1. $\times 6\frac{1}{2}$
Scale of a Spring Salmon caught in River Luing. Weight $16\frac{1}{2}$ lbs., $4\frac{1}{2}$ years old. Shews two hibernation bands very distinctly. A maiden fish.

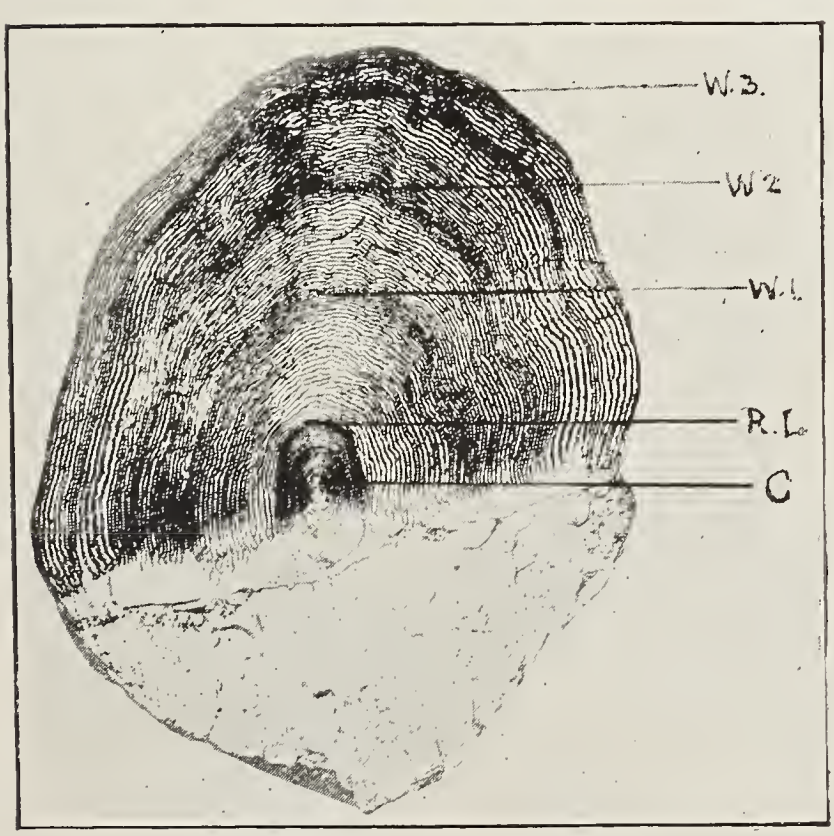
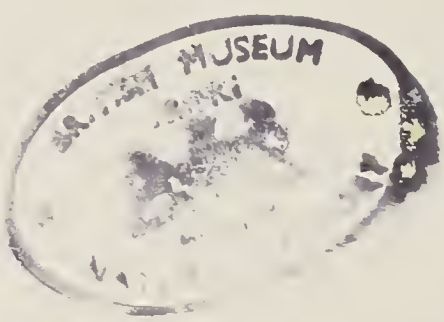


Fig. 2. $\times 6\frac{1}{3}$
Scale of a Salmon 21 lbs., shewing 3 years river life, and $3\frac{1}{2}$ years in the sea. Age $6\frac{1}{2}$ years. A maiden fish.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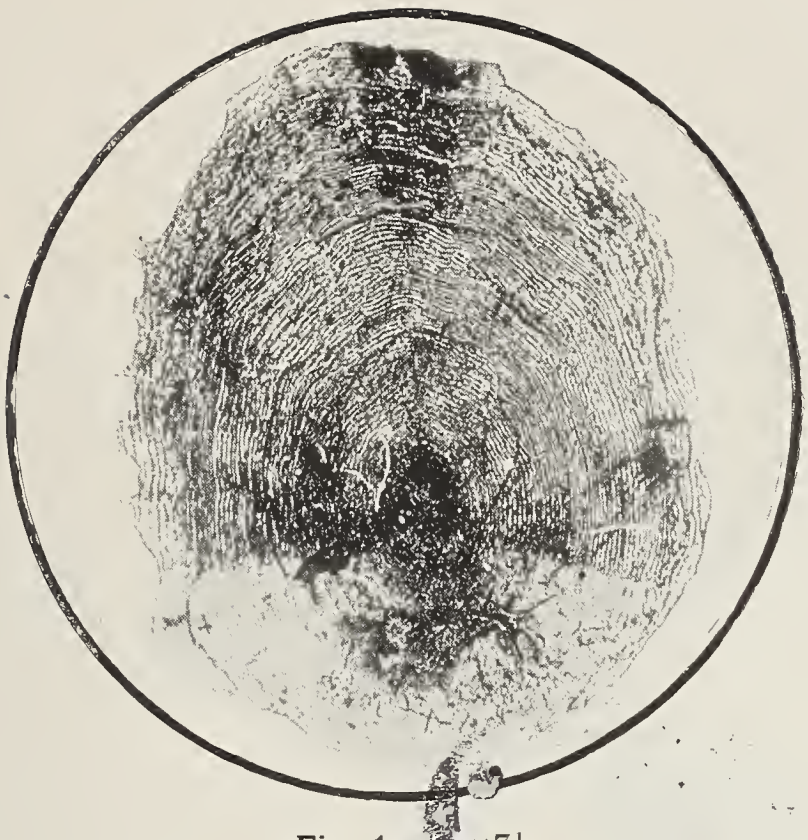


Fig. 1. ×7½
Scale of a Kelt caught in the River Wye descending to the sea, after its first spawning. Note the frayed edges of the scale.

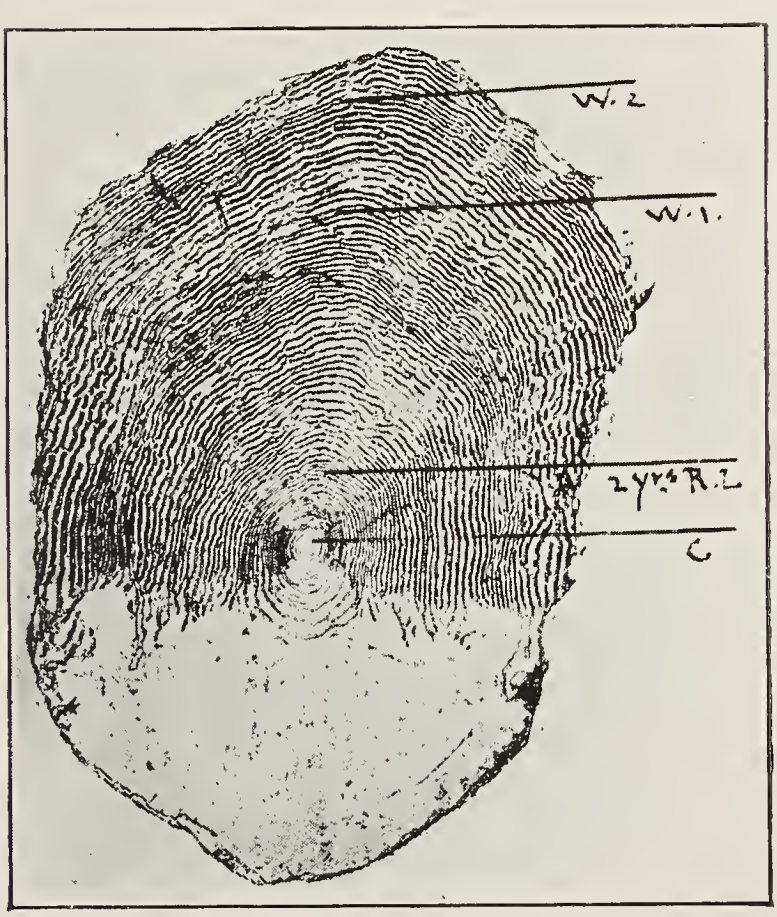


Fig. 2. ×8½
Scale of a Kelt caught in River Frome descending to sea after spawning for first time. Note the considerable portion of the scale, which has frayed away, as a concomitant of spawning. It weighed 7 lbs. when caught, and was 4½ years old.

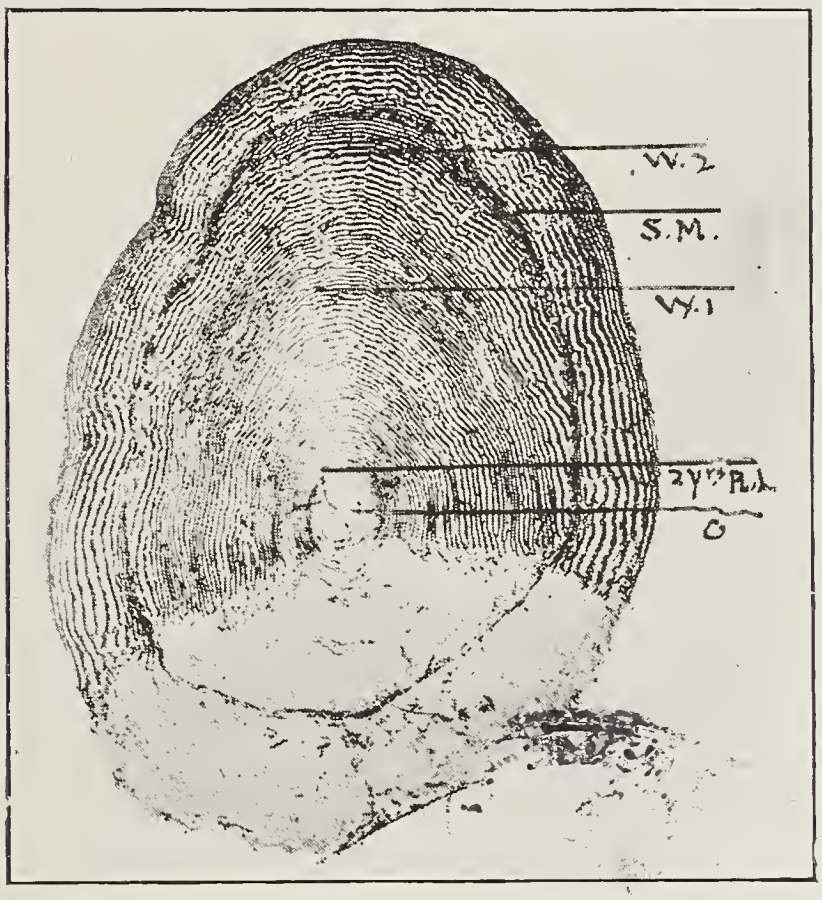


Fig. 1. ×8
Scale of a male Salmon caught in the River Frome. Weight 24 lbs., length 38 inches, girth 21 inches. A spring fish shewing a spawning mark. Five years old.

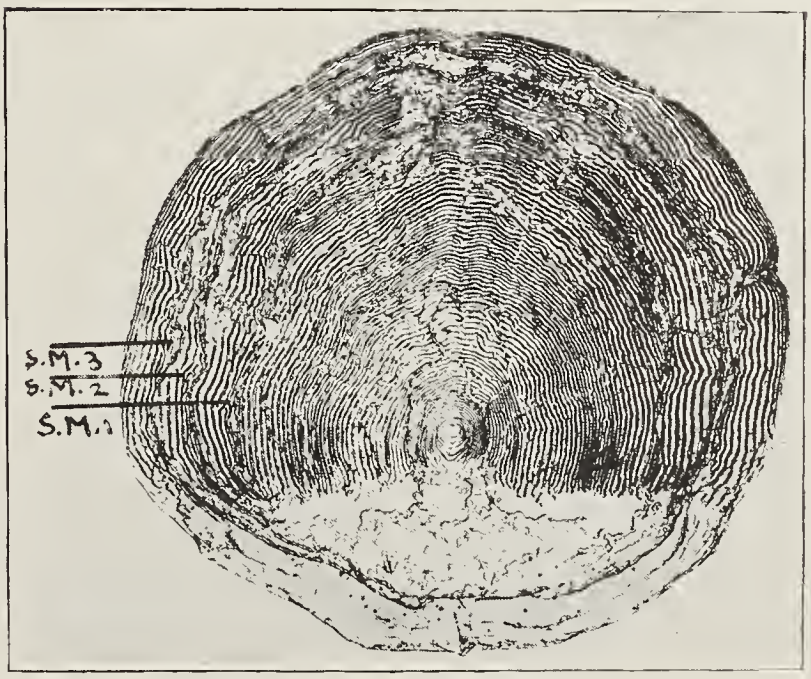
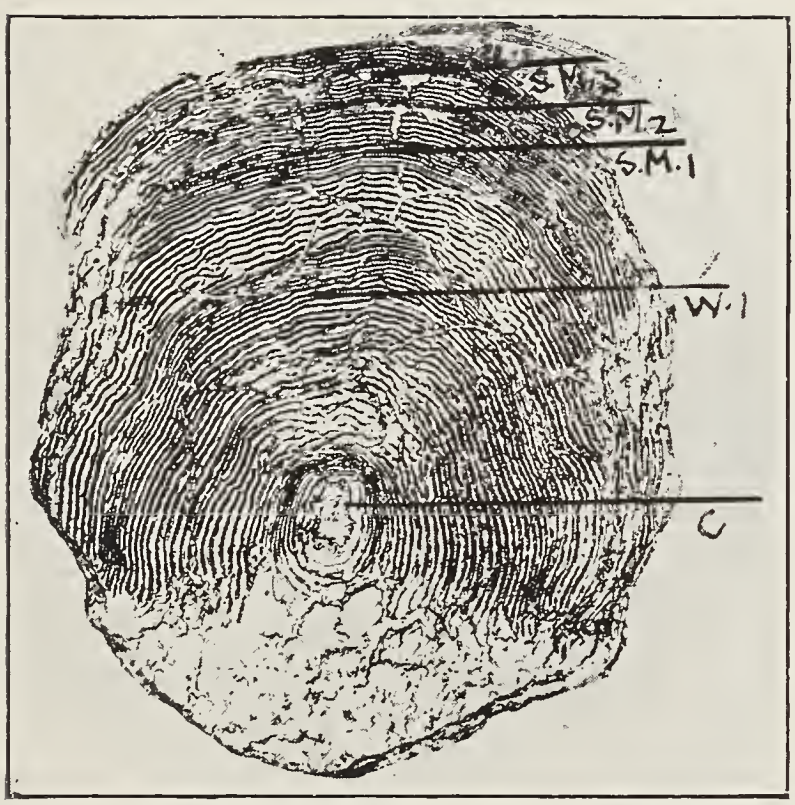
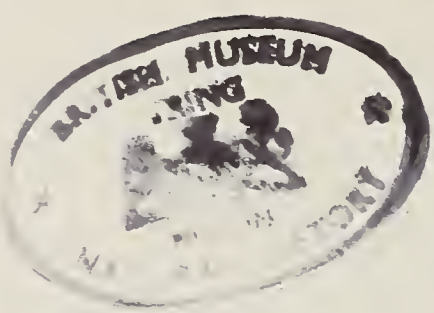


Fig. 2.
Scale of a female Salmon caught in the River Wye, weighing 29½ lbs., length 43 inches, girth 21 inches. It shews three spawning marks and was ascending for a fourth spawning.

NATURAL HISTORY



Scale of a Kelt caught in the River Add. Weight $10\frac{1}{4}$ lbs. It shews three spawning marks and a disintegrated edge of scale, shewing that it had spawned four times, and was descending the river after the fourth spawning.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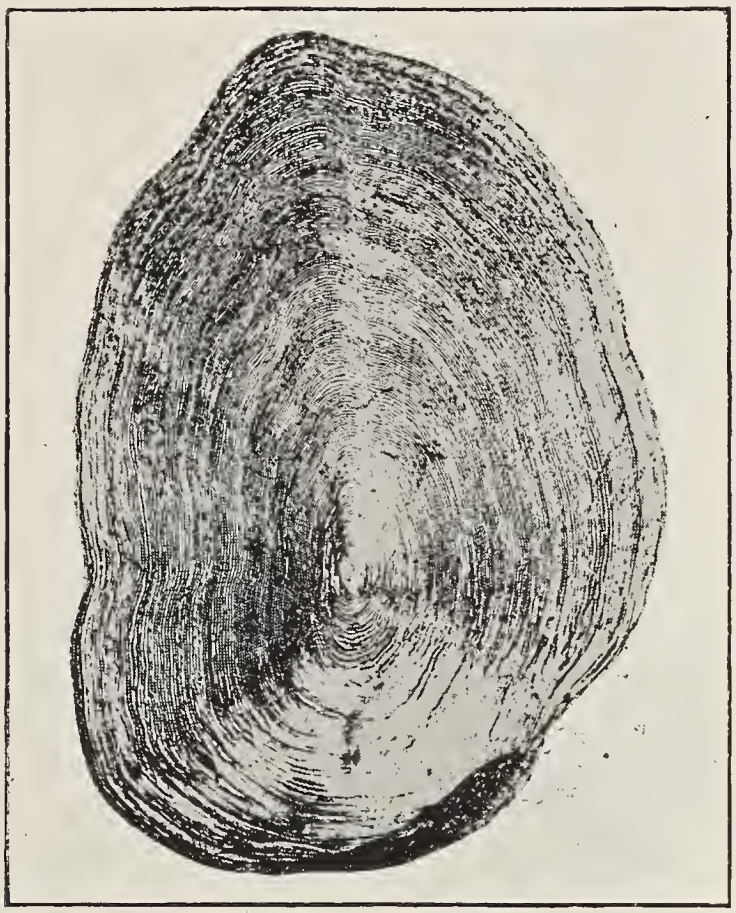


Fig. 1. $\times 8\frac{1}{2}$
Scale of a Brown Trout, 16 lbs. Caught in L. Corrib, Ireland, 15th June, 1913. Shows periodic growth but no spawning mark. Probably 12 years old.

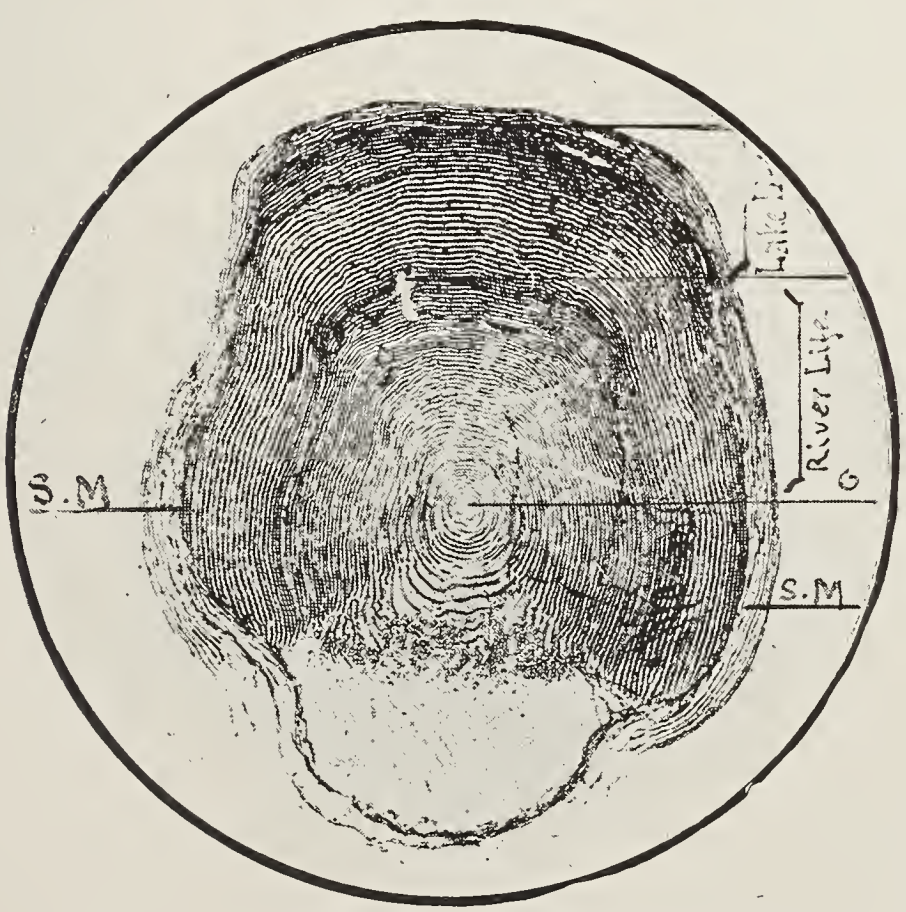
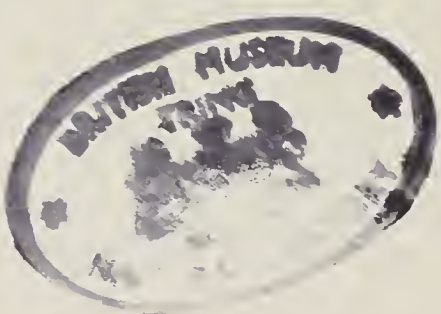


Fig. 2. $\times 9\frac{1}{2}$
Scale of a Rainbow Trout. Weighing 8 lbs. Caught in Lake Taupo, New Zealand. It shews the early river life and the lake life, and a very well defined spawning mark at the edge of the scale.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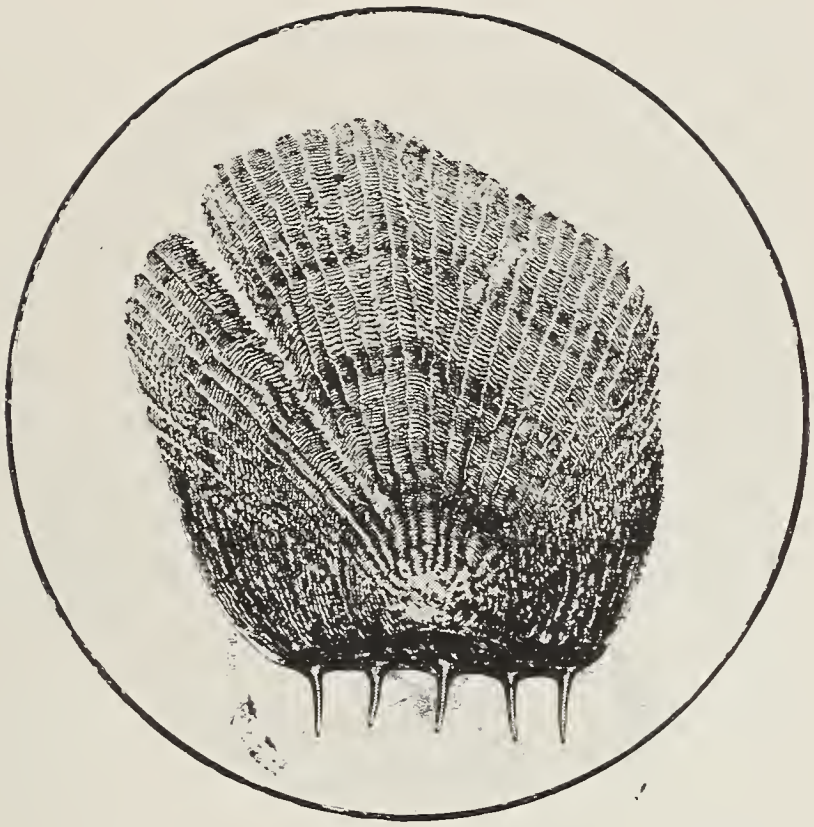


Fig. 1. ×13
Scale of a Dab, weighing ½ lb, shewing distinct periods of growth. Age four years. A fine specimen of a ctenoid scale.

Fig. 2.
This scale shews 21 lines of growth for the first year, and 20 lines of growth for the second year. Age two years. It illustrates a cycloid scale.

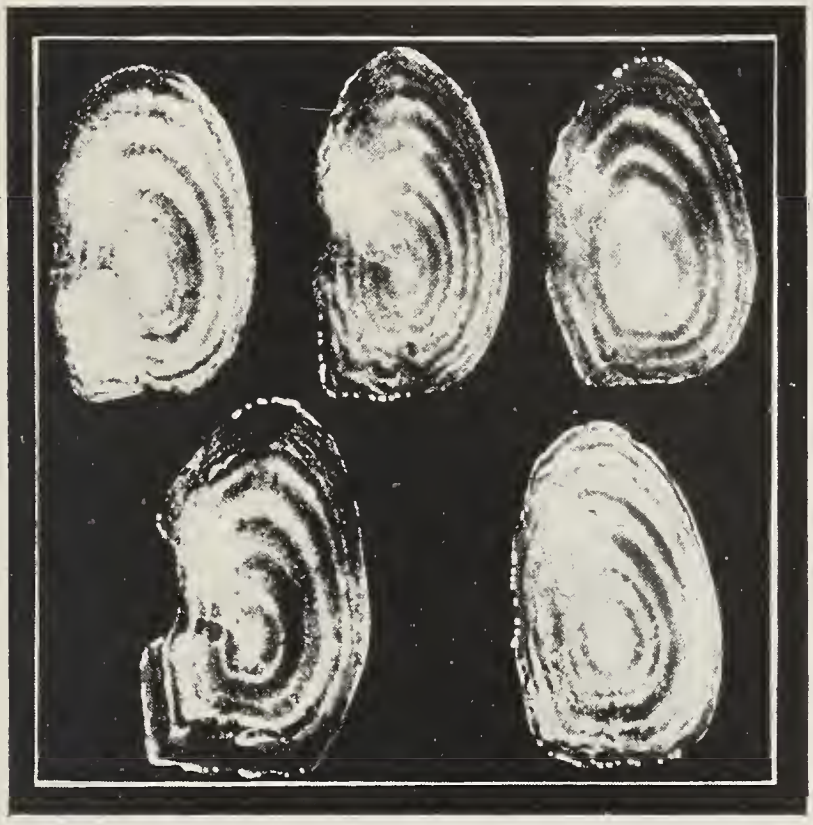


Fig. 1.
Otoliths of a Plaice, shewing seven years growth.

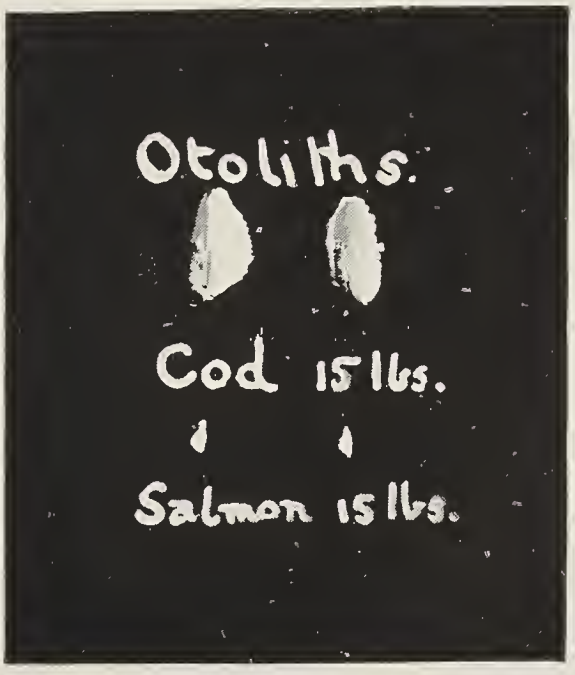
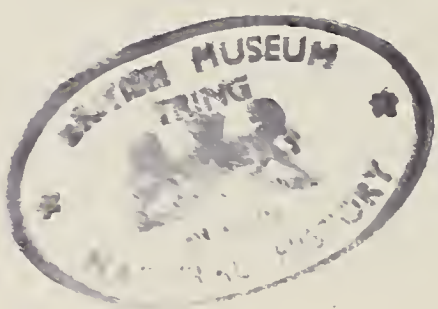


Fig. 2.
Otoliths of a Cod and of a Salmon, each fish weighing 15 lbs The Cod's otolith is 160 times heavier than that of the Salmon of same weight.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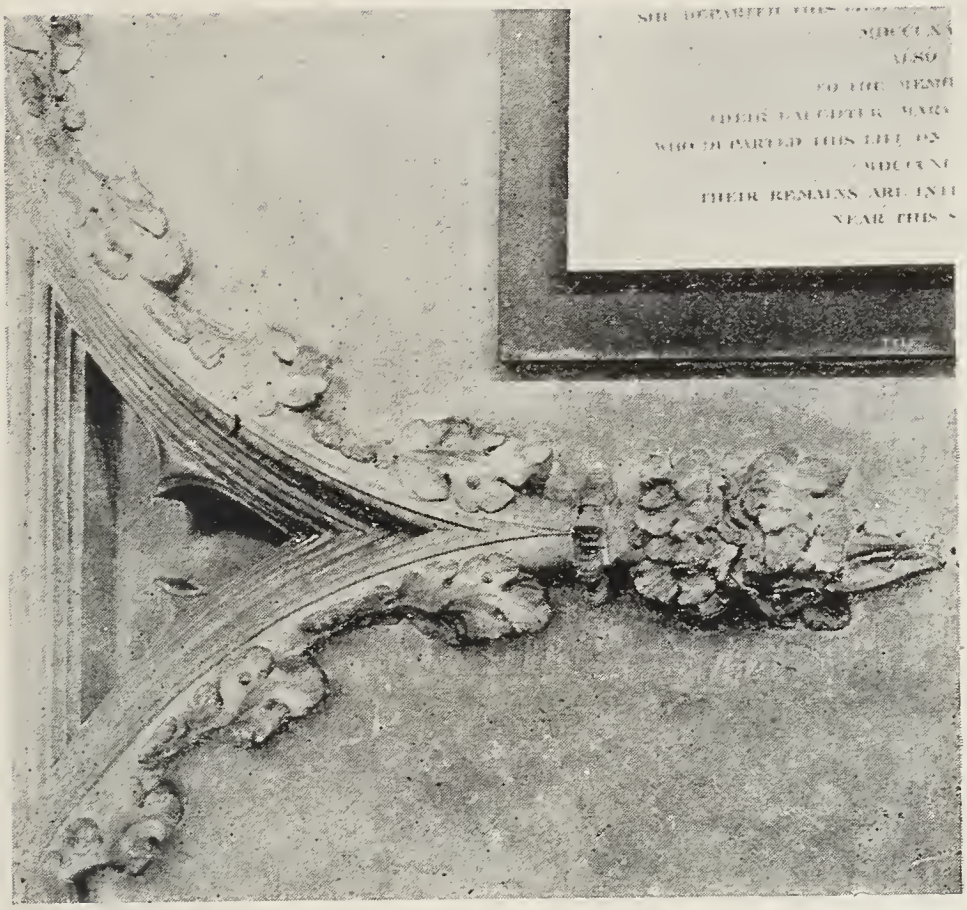

Fig. 1.
Oak leaf with gall.

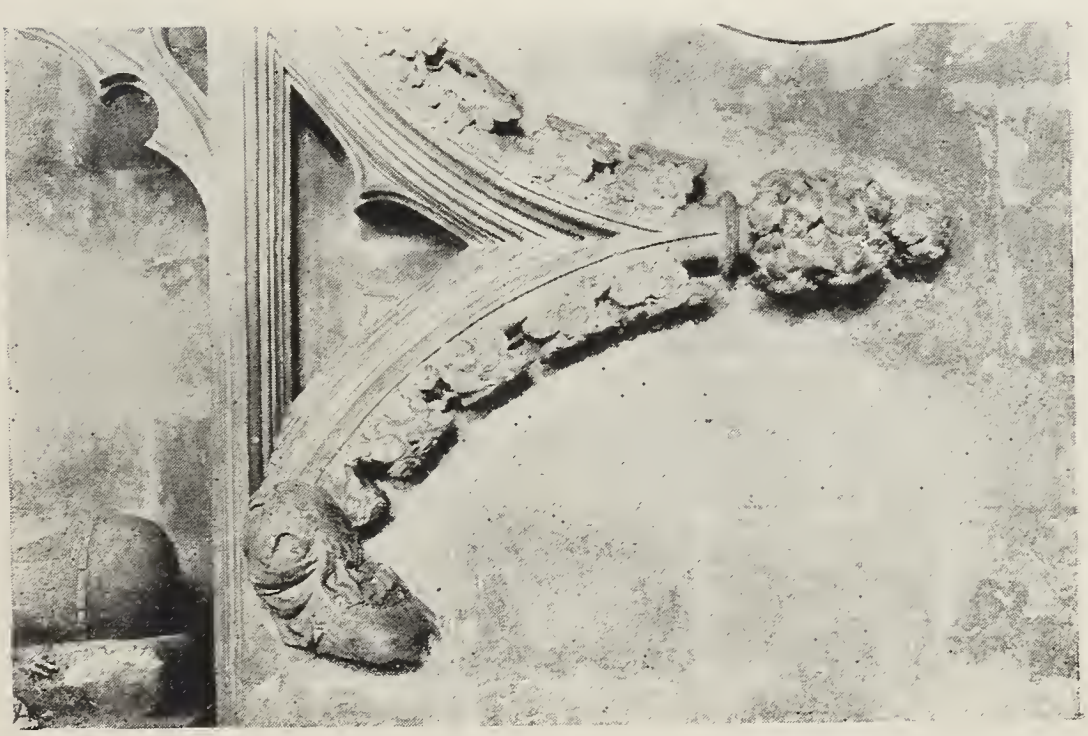

Fig. 2.
Buttercup.

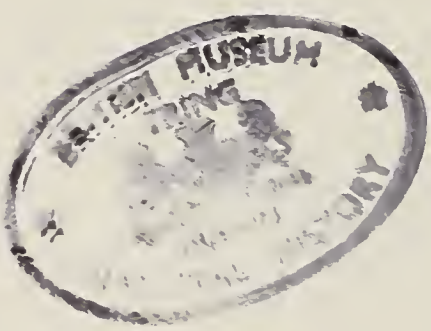
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Plate XIII.

Photo by E. Dodshon.

GODLINGSTON MANOR, SWANAGE.

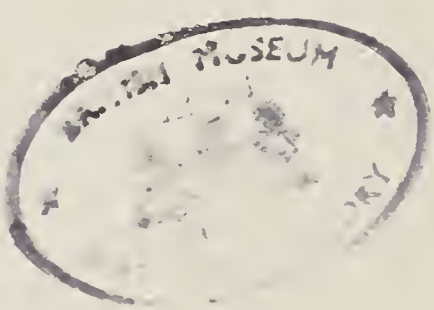
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Fig. 1. Section of a Lenticular Bed of Lignitic Clay, near Durley Chine.

Photos, W. T. Ord.

Fig. 2. Near view of the same—a so-called "Leaf-Bed."

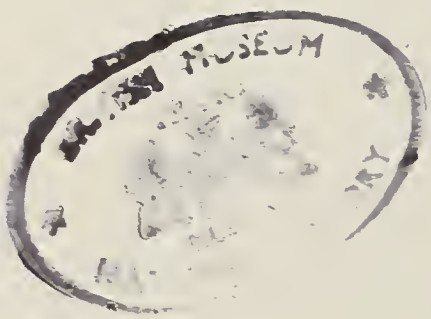
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Fig. 1. Upper Beds of East Cliff near the Lift. (a) Blown Sand, (b) Old Surface Soil, (c) Plateau Gravel, (d) Boscombe Sands, (e) Band of Ferruginous Sandstone, (f) Bournemouth Marine Beds.

Photos, W. T. Ord.

Fig. 2. Lower Portion of Cliff at same point as Fig. 1. Upper Bed of Bournemouth Fresh Water Series at Beach Level.

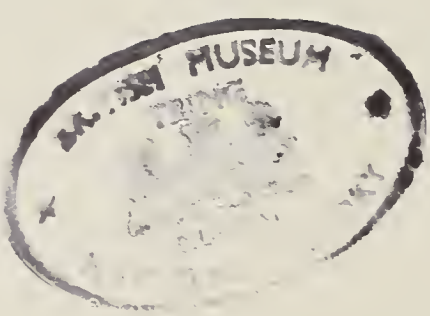
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Fig. 1. Broken Clay Masses redeposited in Sand.

Fig. 2. The same Bed 10 yards east of above. *Photos, W. T. Ord.*

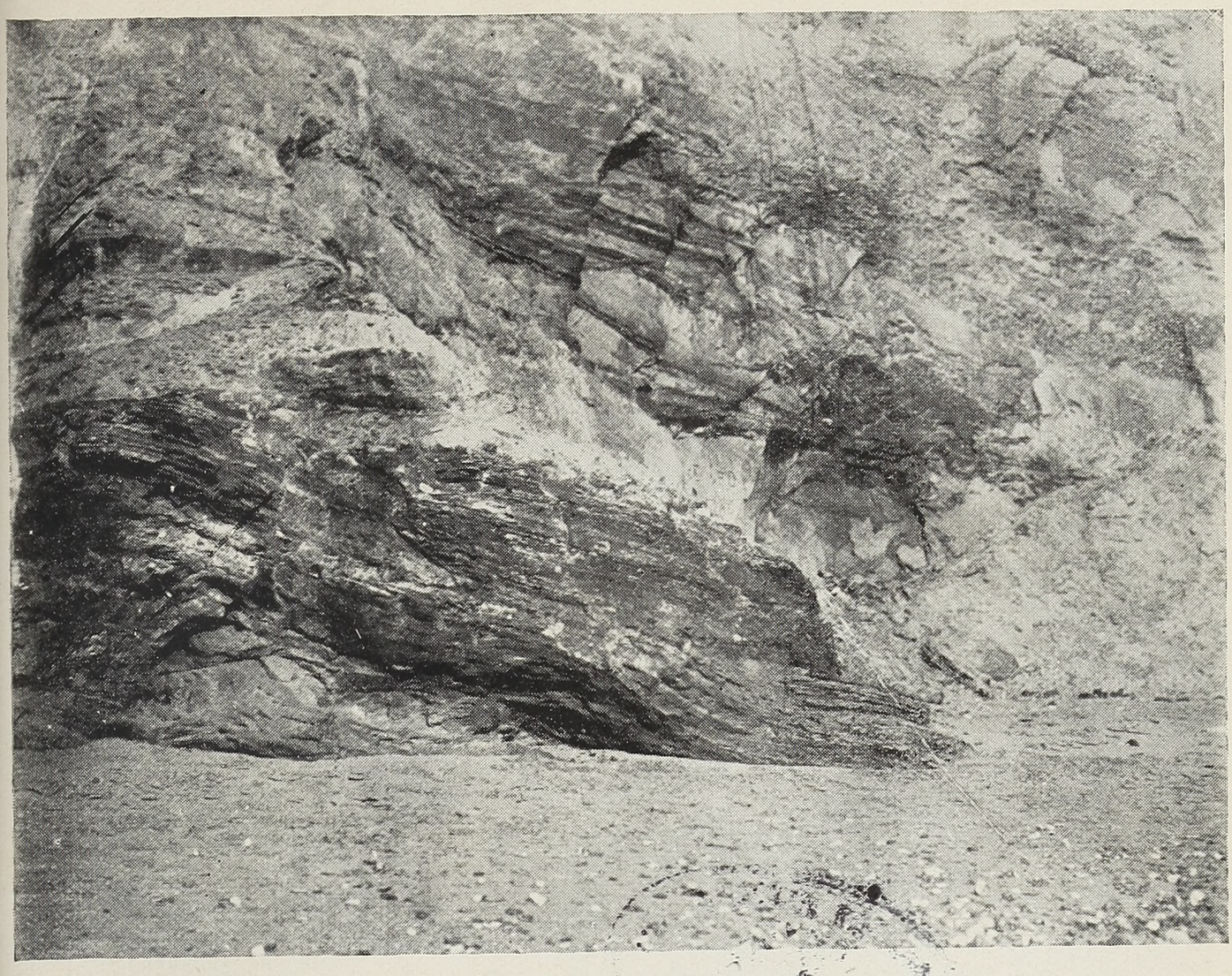
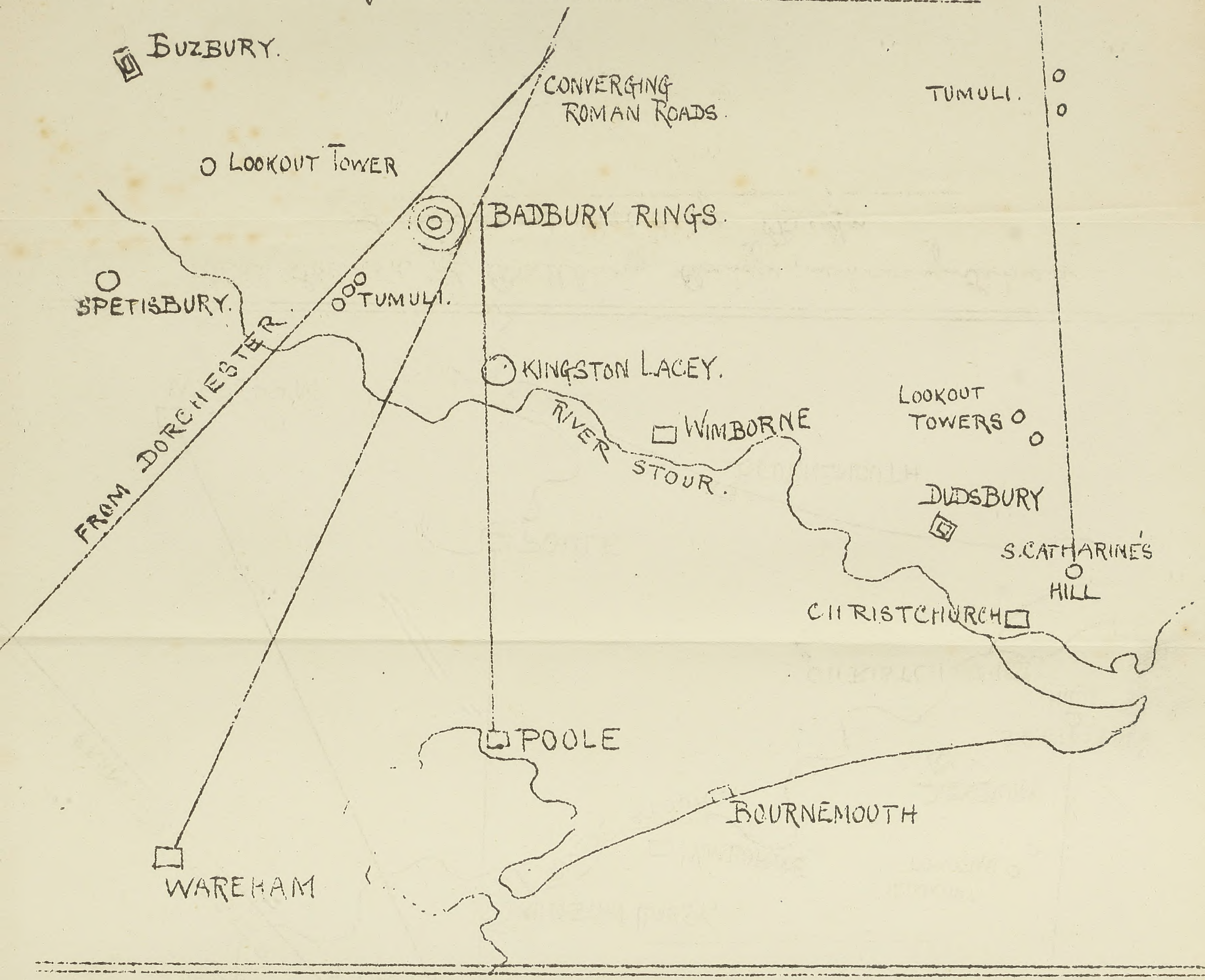


Fig. 1.
Projecting Bluff of hardened Clay with Palm Fronds. The broken beds of plate III. are behind.

Photos, W. T. Ord.

Fig. 2. Two Teredo-bored Tree Trunks projecting from a Sand Bed. [× ×]

Sketch-plan of Badbury and neighbouring pre-historic British Camps.



Ideal Section of Badbury Rings, showing Situation

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